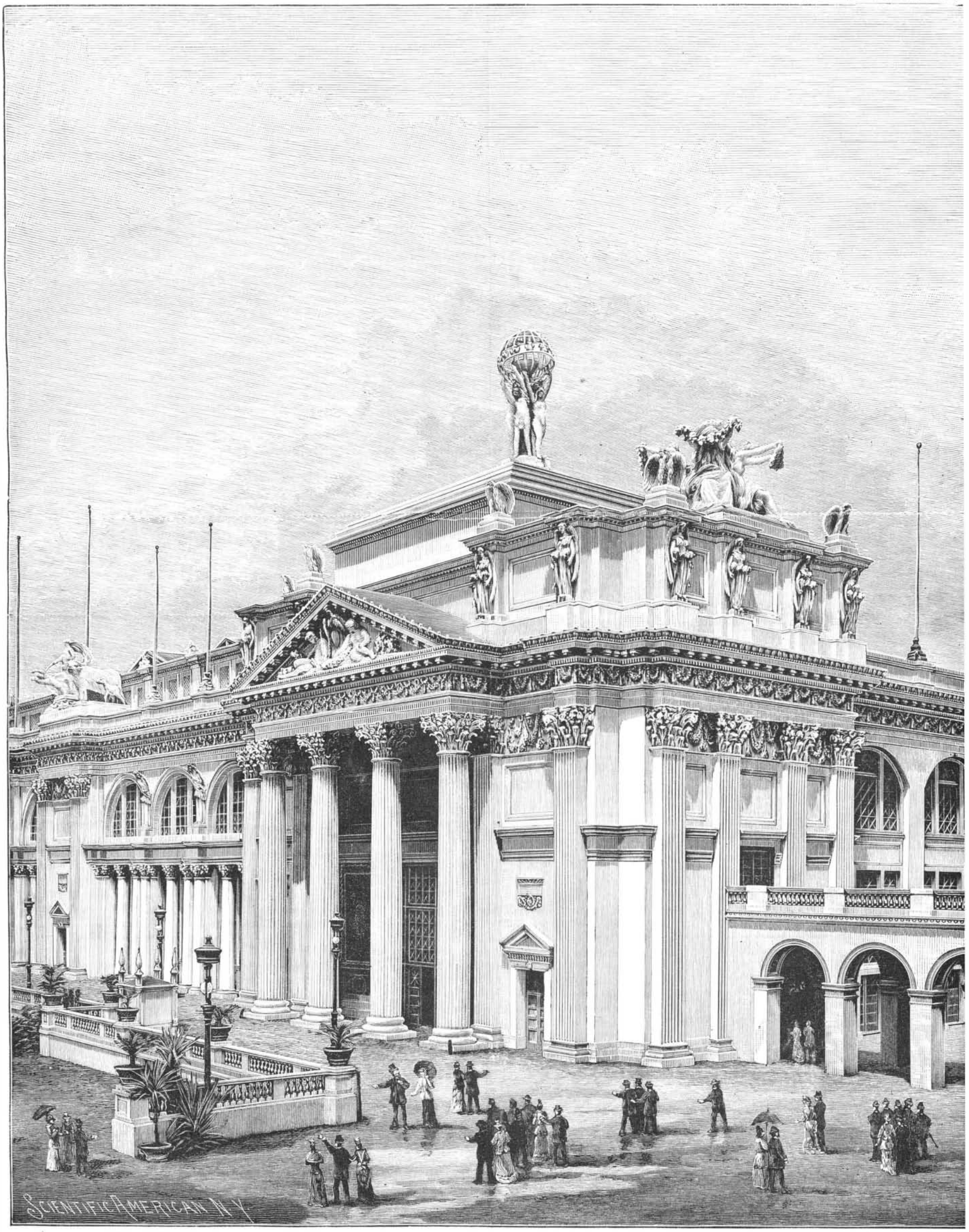
SCIENTIFIC AMERICAN

[Entered at the Post Office of New York, N. Y., as Second Class matter. Copyrighted, 1893, by Munn & Co.

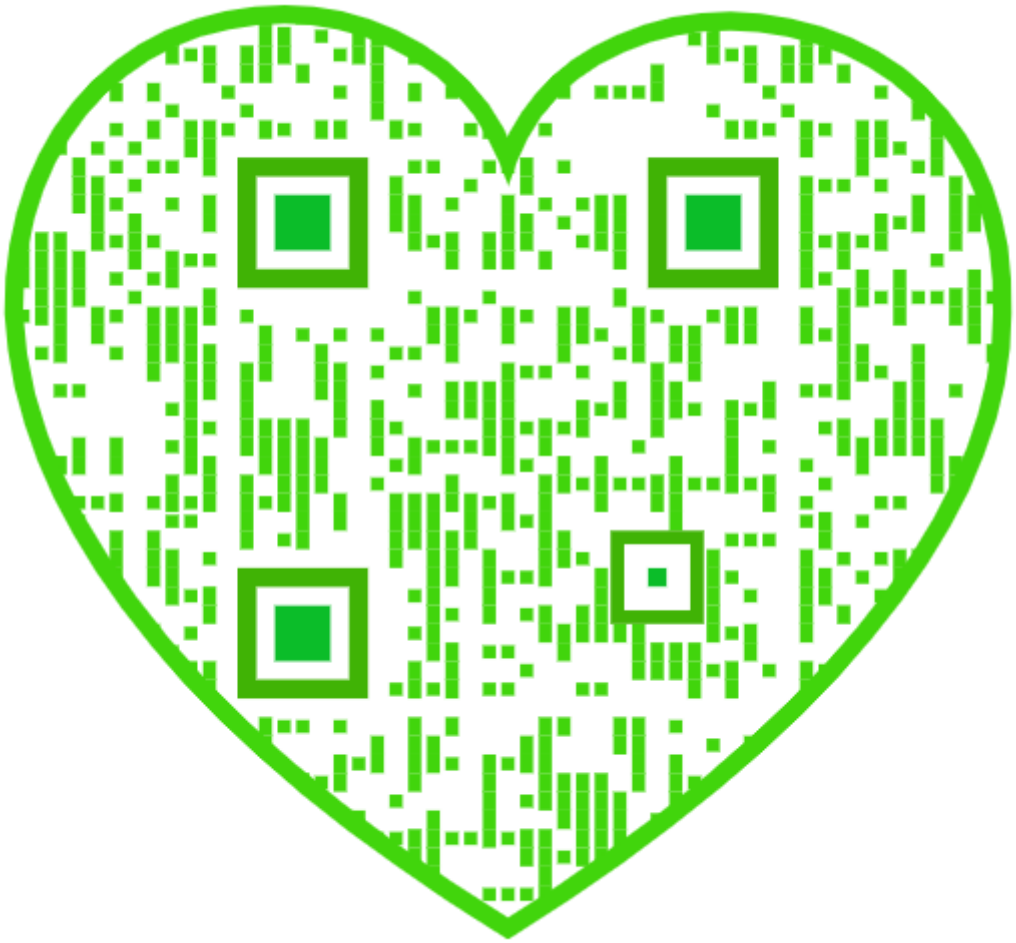
A WEEKLY JOURNAL OF PRACTICAL INFORMATION, ART, SCIENCE, MECHANICS, CHEMISTRY, AND MANUFACTURES.

Vol. LXIX.—No. 9. ESTABLISHED 1845. NEW YORK, AUGUST 26, 1893. $3.00 A YEAR. WEEKLY.



THE WORLD'S COLUMBIAN EXPOSITION—AN ENTRANCE TO THE PALACE OF AGRICULTURE.—[See page 138.]

© 1893 SCIENTIFIC AMERICAN, INC.



Scientific American.

ESTABLISHED 1845.

MUNN & CO., Editors and Proprietors.

PUBLISHED WEEKLY AT

No. 361 BROADWAY, NEW YORK.

O. D. MUNN. A. E. BEACH.

TERMS FOR THE SCIENTIFIC AMERICAN.

One copy, one year, for the U. S., Canada or Mexico.....$3 00
One copy, six months, for the U. S., Canada or Mexico..... 1 50
One copy, one year, to any foreign country belonging to Postal Union. 4 00

Remit by postal or express money order, or by bank draft or checs.
MUNN & CO., 361 Broadway, corner of Franklin Street, New York.

The Scientific American Supplement

is a distinct paper from the SCIENTIFIC AMERICAN. THE SUPPLEMENT is issued weekly. Every number contains 16 octavo pages, uniform in size with SCIENTIFIC AMERICAN. Terms of subscription for SUPPLEMENT, $5.00 a year, for the U. S., Canada or Mexico. $6.00 a year to foreign countries belonging to the Postal Union. Single copies, 10 cents. Sold by all newsdealers throughout the country. See prospectus, last page.

Combined Rates.—The SCIENTIFIC AMERICAN and SUPPLEMENT will be sent for one year, to one address in U. S., Canada or Mexico, on receipt of *seven dollars*. To foreig countries within Postal Union, *eight dollars and fifty cents a year.*

Building Edition.

THE ARCHITECTS AND BUILDERS EDITION OF THE SCIENTIFIC AMERICAN is a large and splendid illustrated periodical, issued monthly, containing floor plans, perspective views, and sheets of constructive details, pertaining to modern architecture. Each number is illustrated with beautiful plates, showing desirable dwellings, public buildings and architectural work in great variety. To builders and all who contemplate building this work is invaluable. Has the largest circulation of any architectural publication in the world.

Single copies 25 cents. By mail, to any part of the United States, Canada or Mexico, $2.50 a year. To foreign Postal Union countries, $3.00 a year. Combined rate for BUILDING EDITION with SCIENTIFIC AMERICAN, to one address, $5.00 a year. To foreign Postal Union countries, $6.50 a year. Combined rate for BUILDING EDITION, SCIENTIFIC AMERICAN and SUPPLEMENT, $9.00 a year. To foreign Postal Union countries, $11.00 a year.

Spanish Edition of the Scientific American.

LA AMERICA CIENTIFICA E INDUSTRIAL (Spanish trade edition of the SCIENTIFIC AMERICAN) is published monthly, uniform in size and typography with the SCIENTIFIC AMERICAN. Every number of *La America* is profusely illustrated. It is the finest scientific, industrial trade paper printed in the Spanish language. It circulates throughout Cuba, the West Indies, Mexico Central and South America, Spain and Spanish possessions—wherever the Spanish language is spoken. $3.00 a year, post paid to any part of the world. Single copies 25 cents. See prospectus.

MUNN & CO., Publishers,
361 Broadway, New York.

☞ The safest way to remit is by postal order, express money order, draft or bank check. Make all remittances payable to order of MUNN & CO.

☞ Readers are specially requested to notify the publishers in case of any failure delay, or irregularity in receipt of papers.

NEW YORK, SATURDAY, AUGUST 26, 1893.

Contents.

(Illustrated articles are marked with an asterisk.)

Agricultural inventions, recent.. 140
Algonquin Park..... 140
Argentine, or silver paper..... 138
Arithmetic, teaching, Gallegos' device for*..... 132
Armour Institute Chicago..... 130
Books and publications, new..... 143
Boring machine, circular and elliptical*..... 138
Bridge, Warburton, England*... 138
Carborundum metal..... 134
Cement, an adhesive..... 138
Color blindness at Miller school. 137
Columbus vessel, a, at the Fair*. 127
Daisy, a twin*..... 130
Electric fan motors (1888)..... 141
Electric light, submarine (1888). 141
Electric storage patent decision. 137
Electric trolley, the latest..... 139
Exposition, Columbian, Agricultural building at*..... 129
Exposition, Columbian, gold and silver refining exhibit*..... 132
Exposition, Columbian, the Century vase*..... 137
Exposition, Columbian, the Santa Maria at*..... 137
Exposition notes..... 131
Fishing by electricity..... 140
Flies, sudden death to..... 133
Gold and silver refinery, a*..... 132
Horse, the intelligence of..... 130
Inventions recently patented... 140
Iron, the malleability of..... 133
Iron industry, the..... 136
Irrigation, prehistoric in Arizona 136
Kindergarten teaching devices, Gallegos'*..... 132
Magnetic lag, experiment showing*..... 134
Man in South America..... 139
Meteors, the August..... 134
Notes and queries..... 141
Optical photometer, a simple.... 138
Paper, metal surfaced..... 130
Patents granted, weekly record. 141
Peach yellows..... 140
Photographic focusing glass, new*..... 144
Photography, color..... 130
Platinum..... 130
Polar expedition, Dr. Nansen's.. 139
Pork pie poisoning..... 136
Railroads, elevated, New York.. 133
Railways in the U. S., progress of 130
Sailing, great circle..... 133
Saw finishing machine, St. Louis'* 132
Silver, how to oxidize (5287)..... 141
Slide valve, Neeley's*..... 132
Soap bubble solution..... 138
Spelling, teaching, Gallegos' device for*..... 132
Spiders and their foes..... 139
Steamer, pioneer, of the Pacific. 130
Steamer, the modern..... 138
Steel for a cent a pound..... 139
Telephone patent, the Berliner. 137
Torpedo boat Ericsson, the new. 137
Torpedo boat of 1858, Nasmyth's* 135
Vinegar, genuine..... 135
World's Fair, the next..... 134
Xylith, or wood-stone..... 134

TABLE OF CONTENTS OF

SCIENTIFIC AMERICAN SUPPLEMENT

No. 921.

For the Week Ending August 26, 1893.

Price 10 cents. For sale by all newsdealers.

PAGE

I. AERONAUTICS.—International Conference on Aerial Navigation.—By O. CHANUTE..... 14724

II. ANTHROPOLOGY.—Among the Aborigines of Australia.—Popular count of this interesting race, and of some of their laws and customs.—4 illustrations..... 14721

III. ARBORICULTURE.—Decorative Planting.—How to plant trees in small parks..... 14722
The Greenheart Tree.—A tree of Guiana of great durability.—1 illustration..... 14723
Do Plants Think?..... 14724

IV. CIVIL ENGINEERING.—Gully and Road Cleansing Apparatus.—Apparatus for removing dirt from culverts under streets and roads.—3 illustrations..... 14717

V. COLUMBIAN EXPOSITION.—The Horticultural Palace at the Chicago Exposition.—A beautiful collection of exhibits.—The Japanese garden.—1 illustration..... 14723

VI. COSMOLOGY.—The End of Our World.—By CAMILLE FLAMMARION.—A pen picture of the possible end of the earth..... 14725

VII. EDUCATION.—The Ideal Engineering Education.—By Prof. WILLIAM H. BURR, of Columbia College, New York.—The conclusion of this important paper, answering some of the most pregnant questions of the day..... 14715

VIII. ELECTRICITY.—Insulators for High Voltage.—How to insulate high pressure electric wires, and how to guard against lightning.—3 illustrations..... 14715

IX. GEOLOGY.—Ancient River Beds of the Forest Hill Divide.—Interesting geological features of the Sierra Nevada.—8 illustrations..... 14720

X. METALLURGY.—The Electrolytic Extraction of Gold.—A combined electrolytic and amalgamation process for gold ores.—1 illustration..... 14715

XI. MINING ENGINEERING.—Arsenic Works on the Tamar.—By S. BARING-GOULD.—A popular account of the Cornish arsenic mines and of the characteristics of the operatives.—3 illustrations 14714

XII. NAVAL ENGINEERING.—Screw Turbine Propeller.—A propeller especially adapted for light draught vessels, giving high thrust with small diameter.—1 illustration..... 14716

XIII. PHOTOGRAPHY.—Photography of the Human Eye.—The history of attempts to photograph the retina, and of the most recent results.—3 illustrations..... 14718

XIV. PHYSICS.—Henry's Photoptometer.—Apparatus for determining the beginning of darkness.—1 illustration..... 14719
The Permeability of Glass.—A curious investigation of Boyle's.—An interesting contribution to the history of science..... 14719

XV. SOCIAL SCIENCE.—The Labor Syndicates and the Labor Exchange.—The organization of the French workmen and their headquarters in Paris.—4 illustrations..... 14711

XVI. TECHNOLOGY.—How to Test the Finish of a Cloth.—Practical tests for cloths.—Full directions for its examination by the purchaser..... 14714
Magnesia Bricks.—The manufacture of refractory furnace linings for the basic steel processes and for other uses..... 14713
The Distribution of Refrigeration in Cities from Central Stations.—The recent installation of this process in St. Louis and Denver.—Its possibilities and its economy..... 14717

PROGRESS OF RAILWAYS IN THE UNITED STATES.

From Poor's Manual for 1893 we learn that the total length of track existing at the close of 1892 was 175,223 miles, for which the aggregate liabilities of the various companies was, in round numbers, eleven thousand and eighty-nine millions of dollars ($11,089,000,000). The aggregate amount paid for operating expenses for 1892 was eight hundred and forty-six millions six hundred and thirty-three thousand dollars ($846,633,000). The total traffic receipts were one thousand two hundred and five millions of dollars ($1,205,272,023), and the net earnings $358,638,520. The number of passengers carried was 575,769,678, and of freight 749,331,860 tons.

Out of this nearly two hundred and thirty-three millions of dollars were paid for interest, and a little over eighty-three millions went for dividends.

The aggregate rolling stock at the close of 1892 was as follows: Number of locomotives, 35,754; passenger cars, 26,321; baggage cars, 7,900; freight cars, 1,168,867.

ARMOUR INSTITUTE.

Armour Institute, the great technical school of Chicago, will open its doors on September 14 to 400 students, who have been enrolled by the president, Dr. Frank W. Gunsalus. The equipment in mechanical and electrical engineering is very fine, and some idea of the shops may be obtained when it is stated that a 150 horse power engine can be built in the machine shop. The equipment of electrical testing instruments is very remarkable, nearly all of them being purchased from the exhibits of the Fair, the buying being done by Mr. Stine, who is a juror of awards in the electrical department. The four years' course in electrical engineering at the institute will be very thorough, and will aim to prepare students to hold responsible positions in electrical companies, for the commercial side of the science is to be treated in a more practical manner than in the other institutions which have courses in electrical engineering. The Armour Institute's electrical department is divided into four laboratories. The main laboratory will be fitted up with fifteen dynamos and motors as well as all the leading makes of transformers, and regular station voltmeters, ammeters, meters, etc. The second section will be known as the galvanometer laboratory and will contain much of the high class apparatus purchased at the Fair. The institute will offer to electric light stations and colleges a testing bureau for standardizing resistances. The third laboratory is on the ground floor and all the apparatus will be mounted on stone piers to prevent vibration. The fourth laboratory will be devoted to the measurement of the candle power of lamps and will be fitted with the best photometric apparatus obtainable. The Armour Institute has every chance of having a brilliant future.

COLOR PHOTOGRAPHY.

The subject of color photography has occupied the minds of investigators from the earliest days of the art. Even Daguerre and Niepce in their work with the mercurialized film on polished silver gave an approach to its latest development, the Lippman process. We have given notices of this assumed triumph of photography—but which has been virtually relegated to its proper place, the science of physics. Lippman's process simply consists in the production of a film, by photographic printing or exposure, whose thickness varies with the color of the light which has fallen on it. This film, by the interference of light, produces the well known colors of thin films, the same that are seen in the soap bubble. Lippman has succeeded to a limited extent in producing an image of the spectrum. This is about as far as color photography has yet gone.

The low actinism of colors belonging to the red end of the spectrum necessitates a very long exposure. This objection might be overcome. But the whole development up to date is one of great interest from the physical standpoint, while it is of but little value from the photographic standpoint. It indicates in the art sense a very short step in advance. The production of a portrait or landscape by the Lippman process is yet an achievement to be hoped for. Its accomplishment is very problematical.

It is of interest to note the status of color photography, as an exaggerated report of the Lippman processes has been extensively circulated. When it is realized that the daguerreotype itself presents a strong analogy to Lippman's work, it will be evident that we should not be too sanguine of our hopes of an early realization of color photography.

Intelligence of the Horse.

Recently a New Jersey farmer, while passing along the street in New York, heard the well known "neigh" of his good old horse, which had been stolen from his barn last winter, six months having elapsed. The farmer turned, and there, sure enough, was the affectionate old animal, hitched to a butcher's wagon. The horse had recognized his master, and gave him the accustomed signal. The farmer recovered his property and the thief was arrested.

The Pioneer Steamer of the Pacific Ocean.

Nearly threescore years have passed since the Hudson's Bay Company's steamer Beaver floated down the Thames. The Beaver was the first European steamer to round Cape Horn and was the pioneer steamer of the Pacific Ocean, the passage from London to Astoria, Oregon, consuming 163 days. The Beaver was 101 feet long, 20 feet broad and the depth was 11½ feet, the tonnage being 109¾. The boiler and the two side lever engines, of 35 horse power each, were made by Boulton & Watt at their Birmingham works. The engines cost £4,500 and weighed 52 tons. The vessel was built in the most substantial manner of live oak and greenheart, the timbers being held together by copper bolts. The Beaver was used as a fur trading vessel by the company, and on one of these trips coal was discovered on Vancouver Island. In 1849, during the gold excitement, many miners took passage on this little black steamer. In steaming out of Burrard Inlet in the fall of 1888 she struck a rock, and, wrapped in a sheet of troubled waters, with head resting on a huge barnacle-clad bowlder, the Pacific pioneer steamer Beaver passed into history. Unsuccessful efforts were made to float the Beaver and she remained on the rocks nearly four years. An attempt was made to take the Beaver to the World's Fair, but was abandoned, owing to her damaged condition and the cost of transportation. Messrs. McCain & Menzies, well known contractors of Vancouver, B. C., purchased the vessel and obtained 975 pounds of old brass and copper, which will be made up into souvenir medals. The number will be limited and each will be stamped with a number, to prevent any possibility of counterfeiting. The timber has also been worked up into souvenir canes, etc. Built and equipped at a period when steam navigation was in its infancy, it is scarcely a wonder that there should be a call for souvenirs of the first steam vessel to plow the broad Pacific.

Platinum.

The mining of this valuable metal is chiefly in Russia, and the following information is given by Mr. Geo. F. Kunz in the report of the mineral industries in the United States at the eleventh census. The two deposits in the Ural Mountains are the Goro-Blagodat or Isa region, in the basin of the river Isa, and the Nisjne Tagilsk or Demidoff district, on the Martin River. The former is under government control, while the latter is worked by private enterprise. In the latter field there were three large washing plants and a fourth is being erected. Besides these, the peasants have many small workings, for which they pay two-thirds of the produce as a royalty. The deposits are placers composed of serpentine bowlders, mixed with chrome iron ore, the platinum-bearing sand forming a layer of 6 inches to 10 inches in thickness on the bed rock, at a depth of 30 to 40 feet. The sand is mined by driving levels from a shaft, and is only worked in the winter, when the washing plants have to stand idle, as the water is all frozen. For washing the material, it is hauled in cartloads of about 1,500 pounds and emptied into a revolving screen. The small stuff is stirred up in water by two women and the heavier materials settle in riffles in the troughs. Both the tailings and the heavy sand are rewashed. In two shifts of 12 hours—each shift, however, including 4 hours' rest—about 640 tons of sand are washed, yielding 2·7 pounds of platinum in each machine. The average daily yield of the whole of this district is about 9 pounds, worth about £2 per ounce, and the yearly production is about 1,620 pounds.

No details of the cost of mining are available, but the cost of labor for washing in the three plants for the 180 days during which the work could be done is about £7,000. Wages are not extravagantly high, as a driver gets 1·3 rubles a day for himself, horse, and cart, and he has to haul 60 loads daily. For each machine, 40 drivers, besides 16 workmen at 70 kopeks each and 4 women at 40 kopeks each, are employed.

Metal Surfaced Paper.

A well polished yellow brass or nickeled sheet of metal is wetted by means of a paint brush or sponge with a solution of higher alkaline sulphide or hydrosulphide, for instance, a solution containing 5 parts by weight of potassium trisulphide or hydrosulphide to 100 parts of water, and in addition, 1 per cent of spirit which is added to remove any greasy particles which may be present. The plate is then immersed for a short time in a neutral solution of copper sulphate (1 to 5) and transferred to an acid copper bath in which copper is deposited on it. It is immersed in a zinc bath in which it receives a deposit of that metal, and is subsequently treated with a solution of hydro-sulphate of ammonia, mercaptan, or similar compound or allylesulphide previous to pasting the paper thereon or causing the paper to adhere by paste in which the said substances are mixed. The metallic surface of the paper so produced is rubbed over, when dry, with a mixture of gold or silver cyanate with carbonate of potash in order to produce a real gold or silver paper.—*C. Endruiveit, Berlin, Germany.*

© 1893 SCIENTIFIC AMERICAN, INC.

In the Transportation building the exhibits of bicycles occupy a larger part of one of the galleries, and include every kind of bicycle as well as their accessories. The array of wheels is very fine. All the leading manufacturers are represented.

An exhibit of much interest is the tent, camping outfit, and palanquin used by Mrs. French-Sheldon during her recent travels in Africa. The palanquin is made of cane and bamboo, very light, and covered with waterproof material.

Another novel vehicle is a replica of an ancient chariot. The original was found in a tomb at Thebes, Egypt, and is believed to be a Scythian racing chariot. It is now in the Royal Egyptian Museum, Florence, Italy.

South American methods of transportation are well illustrated by life-sized reproductions of the animals used, as well as models of the men and women. These include a Colombian rider's outfit—a man mounted on a fine steed with gorgeous equipments; an "arriero," or mule driver, from Bogota; a pack mule with panniers; a burro with pack saddle; a "lechero," or milk woman, mounted on a mule; a saddled llama; a male cargadore or pack carrier, also a female cargadore; a cargadore or pack carrier, with "silla" or chair on his back for carrying passengers; and a sedan chair of the style used by ladies in Bogota.

Japan exhibits several models of engineering works, one of which is of a cantilever bridge built in 1662, or 231 years ago. This bridge has a span of 161 feet. Another model represents the Kintai bridge of five spans. Other models show a pontoon bridge on the Ogaki Canal sluice, built in 1691 and still used.

In the English section there are exhibited a thrashing engine made by Trevithick in 1812, Earl Durham's bicycle "Dandy Horse," bicycle of fifty years ago, and a model of the Forth bridge on a scale of one inch to forty feet.

Methods and means of transportation in Jerusalem and Syria are illustrated by the exhibit of the United States Consul Merrill. The type of boat now used on the Sea of Galilee is shown, and is said to be the same style of boat used in the time of Christ. Other articles are a palanquin from Jerusalem, a box in which women are carried in wedding processions, a bag for carrying children, a chair for teaching babies to walk, leather bottles for wine, a water jar to be carried on the head, etc.

Steamship traveling is finely illustrated in the French section. Paintings are presented which illustrate the harbor of New York, port of Algiers, port of Marseilles, passengers embarking at Havre for New York, the smoking room on one of the steamers of the Compagnie Generale Transatlantique, interior view of the workshops where these steamers are built, showing the work of constructing a steamer, the engine, propeller and shaft lying about; a dining saloon, where passengers are at the tables.

Germany shows many models of vessels, also models of engineering works, a section of the North Canal at Kiel, and railway engineering undertakings. A model is shown of a boat that was unearthed in the marshes of the Baltic Sea, and which is believed to be about 1,500 years old.

In the navigation section of this country are large models in relief of the works of the Union Iron Works at San Francisco and of the Newport News Shipbuilding Company, Virginia. The several government war vessels that have been constructed at the Union Iron Works are represented by miniature vessels floating just off the docks of these works. The model of the Nicaragua Canal is 30 feet long. Water is used to represent the canal and its connections. A model of the Mississippi River raft boat Juniata is shown, towing an immense raft of logs, also a relief map of the State of New York, showing the canal systems and boats.

The pavilion of the Standard Oil Company is a white and gold colonnade in Italian Renaissance style, in which Ionic columns alternate with tall lamps and vases of handsome oils. In the center is a lighthouse. A collection of all the varieties of crude petroleum found in the United States is presented. There are about 200 of these specimens, and they are graded by color from black to pale straw. These oils are in the original condition in which they came from the ground. Some of the oils, which are black and thick like tar, are ten times more valuable than the more attractive amber oils. Black oils are obtained from nearly every State where petroleum is found—New York, Pennsylvania, Indiana, Ohio, Kentucky, Illinois, Kansas, Texas, Colorado, Wyoming, New Mexico and California. Blackest and thickest of all is the oil from Louisiana. Among these crude oils is a most unique collection of the sands from which the oils are derived. Hanging in the windows are a large number of transparent photographs showing the processes of obtaining and handling petroleum. One of these transparencies, 50×80 inches in size, represents a relief map of the United States, on which is marked every locality in which petroleum has been found and the color of the oil. Along the front of the exhibit the geology of the oil regions is represented by a profile section from Olean, N. Y., westward through Pennsylvania and Ohio to Fort Wayne, Ind. Here miniature derricks and tanks show where the oil wells are located. Tiny threads of glass filled with petroleum indicate the depth of wells and grade of oil produced.

How oils and other products are prepared is shown in a miniature working refinery of glass.

The manufactured products are arranged on stands which radiate from a huge bottle of crude oil in the order in which they are obtained. This central bottle holds one barrel—which is the quantity delivered by the pipes lines of the United States during every second of time throughout the year. The primary divisions are naphtha, burning oils and residuum or petroleum tar. One case displays the naphtha derivatives. In a larger case all the oils are collected which boil at higher temperatures than naphtha. All these distillates require treatment with sulphuric acid before they yield the merchantable product. A third case shows a jar of residuum; other specimens show how it is redistilled, yielding a light oil for fuel and a heavier distillate for lubricating oils. There is also a piece of "tar still coke," which is the final residue left in the still. The "heavy distillate" is next shown treated by sulphuric acid, then chilled till a quantity of paraffine wax is crystallized out. This is pressed out and pressed again, yielding successively soft paraffine, "chewing gum stock," or hard paraffine wax for candles. A mound of pure white paraffine is the starting point for candles. Other cases show how the black unattractive coke is transformed into carbons for electric lights, battery cells and other uses, and also the uses for paraffine wax, the latest use being lemonade straws. These are simply pieces of paper rolled up and coated with this wax.

The exhibit of the evolution of the oil lamp begins with a large pebble hollowed on one side, filled with oil and supplied with a wick. This is used by the Esquimaux. The next queer lamp is a shell laid on a three-pronged stick with a bit of twisted bark for a wick. This is from Japan. Then there are East India lamps of clay; a Bedouin Arab glass lamp; old Roman terra cotta and bronze lamps; Jewish hanging lamps; Flemish lamps, a horological lamp, Moorish lamps, and so on down to latest improved modern lamps.

The State of Washington makes a creditable exhibit in its State building. In front of the building is a mast, one straight piece of fir, three and one-half feet in diameter at the base and two hundred and fifteen feet high. The south wing of the building and the north wing each rest on one piece of timber three feet by three and a half feet in size and one hundred and twenty-five feet long. Each of these pieces was cut from a yellow fir tree seven feet eleven inches in diameter and three hundred and forty feet high. A life-sized full length picture of Washington has a frame made entirely of small pieces of wood, inlaid with seventy-seven different kinds of wood found in this State.

The display of coal, gold and silver ores is large. One piece of coal, believed to be the largest lump ever handled, is twenty-six feet long, five feet four inches high and five feet eight inches wide. It is semi-bituminous, weighs 50,250 pounds and is from the Roslyn mines in Kititas County.

The main part of the building is devoted largely to exhibits of the resources of the soil. The center is occupied by a block some thirty-five feet square, which represents a farm. At one side is a house and other farm buildings and the rest of the area is divided into grain and other fields, with horses, farming machinery and men in miniature, going through the operations of plowing and harvesting.

The Maryland building contains exhibits which give an excellent idea of the oyster industry. Models of oyster boats are shown and a model of an oyster packing establishment.

The original commission which made Christopher Columbus an admiral is now exhibited in a separate glass case on the altar in the chapel of the convent of La Rabida. A United States soldier guards this priceless document. An inscription says: "This is the beginning of American history."

A plaster reproduction of the fishing house which Izaak Walton built on the banks of the River Dove, in England, has been erected among the trees on the shore of the north lagoon. "Piscatoribus sacrum" is the inscription over the doorway, and this is followed by the date 1674.

An apparatus for sterilizing milk is exhibited in the Agricultural building. It consists of a steam chamber designed to hold the bottles, which are held in position by springs. Steam is turned into the chamber, and, as soon as the air is expelled from the bottles by the heat, a vent in the chamber is closed and the milk is subjected to the action of the steam for thirty minutes.

The wheelmen have had their day at the Exposition, and the display last week closed with a procession of over 1,000 bicycles. Many wheels were elaborately decorated and illuminated during the evening.

The Associated American Exhibitors of the World's Columbian Exposition have elected to honorary membership the "Queen of Inventors," Mrs. Harriet Ruth Tracy, of New York, for her notable invention of a rotary shuttle, lock and chain-stitch sewing machine, whose lower bobbin carries over 1,000 yards of thread. Several other inventions by this lady are also shown.

The Algerian village and the theater are in the hands of the sheriff. The seizure was made on a suit of the Columbian Exposition for a percentage on the receipts of the concession, the amount involved being $6,130.

The Swedish commissioners on behalf of the Swedish government have sent a letter to the Foreign Office tendering their national building to the South Park commissioners to be held in trust for the people of Chicago.

The attendants who push the so-called "gospel chairs" struck on August 15, owing to a 25 per cent reduction in their salary of $30 a month. Many of them took off their pretty uniforms, entered the grounds and offered to push visitors for 35 cents an hour. The company got 40 cents for the use of their chairs, so the visitors paid the same as if the regular force of chair pushers was propelling the chairs, but the 35 cents went to the pusher and not the company.

Electrical thief catchers are in operation in some of the sections. Their operation is as follows: Ross & Co., of London, have an exhibit in the British section of the Manufactures building. For some time they have been missing valuable lenses. Finally the case reached such proportions that it was decided to lay a trap for the thief.

Several lenses were temptingly displayed within seemingly easy reach, but underneath each lay one end of an electric wire, to the other end of which was attached a bell. The mechanism was so arranged that, as soon as one of these lenses was touched, an electric bell would ring out like a telephone. The guards in that section of the gallery were told of the trap and instructed what action to take when the alarm sounded.

Just before the Manufactures building was closed Sunday night an elderly man, eminently respectable in appearance and neatly dressed, passed along the aisle and soon the gong was heard. The guards rushed in and there on the floor lay the lenses whose theft the old gentleman had undertaken. He was arrested.

The total paid attendance to August 15 is 7,736,706. Rand & McNally's "A Week at the Fair" gives, under an article signed by D. H. Burnham, director of works, the *estimated* attendance at the Chicago Fair as 35,000,000. The attendance at the Centennial was 9,910,996; at Paris, 1878, 16,032,725; Paris, 1889, 28,149,350.

Owing to the reductions made by the Western lines, the rural population is now making the trip in large numbers. The increased interest in the agricultural exhibits shows that a large portion of the attendance is made up of farmers and their families.

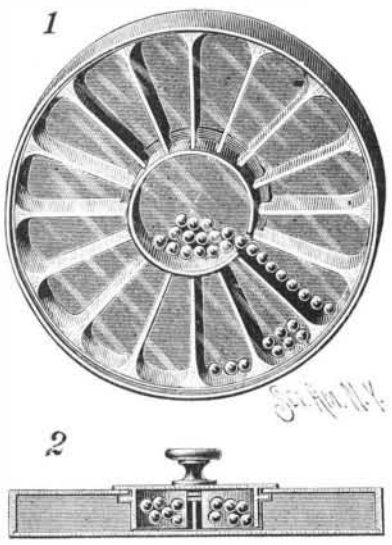
An international swimming match was held in the lagoon on August 11. Captain Concas, of the Spanish caravels, Paul B. Du Chaillu, and Magnus Andersen, of the Viking ship, were the judges appointed. The heathen from the Midway enjoyed the affair hugely. The Zulus, the South American Indians, the Turks, Dahomans, South Sea Islanders, and East Indians, took part in the aquatic contest before the 25,000 spectators. The distance was 1,550 feet, and Adolphus, a native of British Guiana, received the $5 gold piece.

The Rajah of Kapurthala gave the visitors to the Fair on August 15 a glimpse of royal splendor. The Rajah was invited by the director-general to review a procession which was arranged in his honor. The Rajah appeared in a military costume, over which was a loose robe of silk ornamented with gold and glittering with jewels. His attendants bore the insignia of rank which obtains in India; over his head was a gorgeous silk umbrella, and a servant cooled him with a fan of peacock feathers blazing with all the colors of the rainbow. The line of the aquatic procession was through the ponds to the lagoon and the MacMonnies fountain. The barge of the Rajah was decorated with rugs and shawls. A red carpet protected the Rajah's feet from the cruel gravel when he walked to the reviewing stand. He was seated on a throne which was erected on the grand stand. The Rajah enjoyed the procession immensely, and the people all thoroughly enjoyed seeing the Indian potentate in all his glory.

© 1893 SCIENTIFIC AMERICAN, INC.

A KINDERGARTEN TEACHING DEVICE.

An exceedingly simple educational device, adapted for use in the kindergarten method of instruction, is shown in the illustration, and has been patented by Mr. Jose Gallegos, of Ocos, Guatemala, C. A. A light cylin-

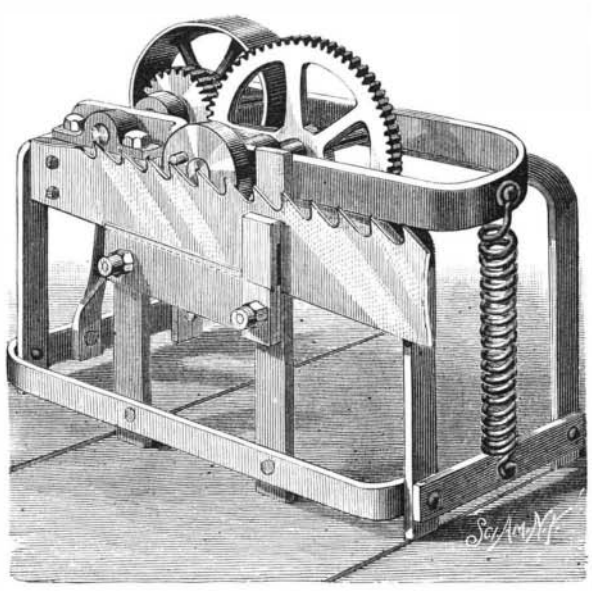


GALLEGOS' DEVICE TO TEACH ARITHMETIC.

drical case, with a glass front, is divided by radial ribs into numerous compartments open at their inner ends, where there is a central recess, in which is placed a circular pocket. This pocket is revoluble by means of a knob or handle at the back of the case, as shown in the sectional view, Fig. 2, and has in one side a slot to permit the balls to pass through, one by one, into the several compartments between the ribs. By permitting one or more balls to pass through the slot, as shown in Fig. 1, the pupil may be taught to add and multiply as the balls are distributed, counting being taught as the balls are dropped one by one through the slot. The device is also designed to serve to some extent to amuse small pupils.

A MACHINE FOR FINISHING SAWS.

A new method of finishing saws, with a machine adapted to facilitate the work, form the subject of a patent recently issued to Mr. Thomas J. St. Louis, of Cadott, Wis. It is designed by this means to prevent the cracking of the saws by removing their sharp edges, destroying the cross creases, and breaking up and removing the case-hardening made by the emery wheel in grinding the teeth. The saw is held upon an anvil on the front side of the frame of the machine, in such a position that each tooth may be engaged by a die in the shape of a pin projecting from a crank disk, as shown in the illustration, the pin-shaped die having a groove in its working edge which straddles the top edge of the saw tooth. The crank disk is held on a transverse shaft mounted in a slightly swinging frame, which has its fulcrum on the main driving shaft, the shaft frame being yieldingly held on the main frame of the machine by a spring connecting it at one end with the base of the machine. A laterally sliding pinion and clutch on the main driving shaft afford the means of causing the rotation of the crank shaft as desired on moving a shifting lever. With the saw held in position, as shown, the rotation of the crank disk moves the die in contact with the top edge of the saw tooth, the die rolling off thereon and finally engaging and rolling in the throat, at the same time pushing the saw forward as the rotation of the disk continues, the yielding frame swinging upward according to the downward movement of the die. The distance of the die from the center of the crank disk is such that at every revolution the saw blade will be moved forward a sufficient distance to cause the die to engage the next tooth on the succeeding revolution, the die in each case exerting a rolling pressure along the top edges of the tooth, in the base of the throat, and up on the forward edge of the succeeding tooth.

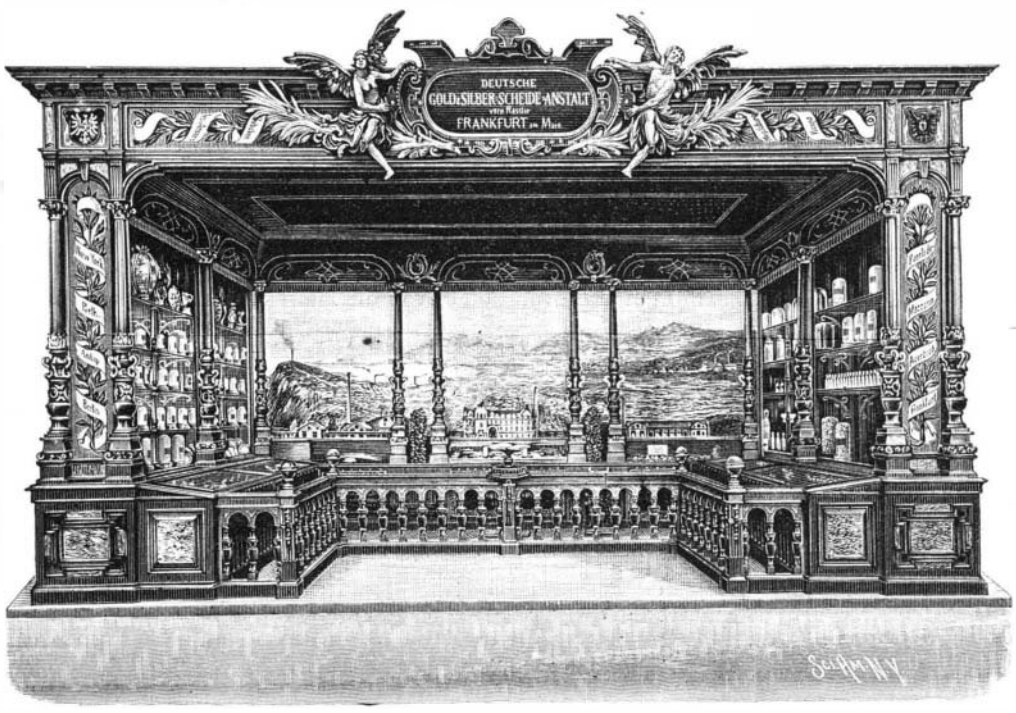


ST. LOUIS' SAW FINISHING MACHINE.

A GOLD AND SILVER REFINING ESTABLISHMENT.

An exhibit in the German department of the Mining building highly pleasing to the eye, through its refined elegance, is the pavilion of the Deutsche Gold u. Silber Scheide-Anstalt, vorm. Roessler (the German Gold and Silver Refinery, late Roessler), Frankfort-on-the-Main, located on the main aisle dividing the building from east to west. The large showcase is entirely constructed of walnut with gold ornamentations, the chemicals, etc., manufactured by the concern and its branches being shown to the right and left in large glass cases, while the background is formed by a plastic and pictorial representation of the different establishments.

Well executed models of the works and the central office in Frankfort-on-the-Main and of the desilverizing establishment at Hoboken, near Antwerp, are mounted in the foreground. To the left is seen the Mediterranean port of Mazarron, in the Spanish province of Cartagena, with the silver-lead ore smelters of the Compania Metalurgica de Mazarron, the Spanish branch of the concern. To the right, the painting represents the Bergstrasse in Odenwald, with the quinine factory Auerbach and the ruin of the old castle of the same name. The azure blue of the Mediterranean, with its bright sky overhead, the brilliant coloring of the southern landscape, and the more somber hues of the Hessian Mountains, all combine to produce a striking effect and to relieve the exhibits, otherwise of a strictly commercial character.



THE COLUMBIAN EXPOSITION—A GERMAN GOLD AND SILVER REFINERY EXHIBIT.

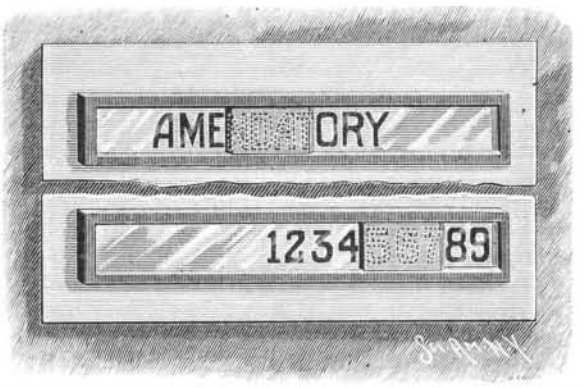
The German gold and silver refinery of the company refines about 9,000,000 ounces gold and silver during a year, and its total sales in 1892 amounted to 10,000,000 ounces silver and 200,000 ounces gold. The chemical works of the concern have a large output of nitrate of silver, chloride of gold, cyanide of potassium, metal oxides, and other chemicals for pharmaceutical and industrial uses. Their ceramic department manufactures liquid bright gold and many hundred shades of overglaze and underglaze colors, the total sales of colors and chemicals being more than 14,000,000 marks per year. The year's production of the quinine factory Auerbach is over 2,000,000 ounces of quinine.

A flat showcase in front of the models contains refined gold in ribbons and grain silver to the value of many thousand dollars. In another case the Roessler & Edelmann's new desilverizing process is demonstrated by a series of products. This patented process, which introduces the aid of aluminum in the old zinc desilverizing process, is for the first time exhibited in any world's exposition. A pamphlet describing fully the process points out as its principal merits the saving of time and material. It is in use in the above named desilverizing works in Hoboken, near Antwerp, where about 67,000,000 pounds of lead, 4,000,000 ounces of silver, and 5.000 ounces of gold are yearly produced.

The Roessler & Hasslacher Chemical Company, an independent New York corporation, with works in Perth Amboy, N. J., whose products were described in a recent issue, is the American branch of the Frankfort concern. Bernhard Roessler & Co. and Louis Roessler & Co. are the branches of the concern in Berlin and Vienna. All these establishments are named on the border of the showcases.

A DEVICE TO TEACH SPELLING.

This is a cheap and simple device, which may be easily carried in the pocket. It consists of a small and light frame, flush with the back side of which is inserted a glass, while its top or outer portion has flanged



GALLEGOS' DEVICE TO TEACH SPELLING.

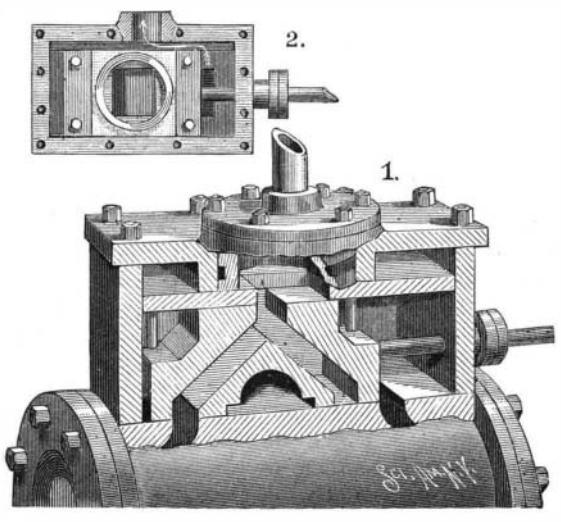
edges adapted to inclose a slide block designed to be moved along over the glass. The device may be applied to words or numbers upon a book or any other surface, so as to cover a portion and expose other portions, dividing the word into syllables and letters, as may be desirable in teaching small children, or exposing successive figures as may be advantageous in teaching the reading of numbers. The improvement has been patented by Mr. Jose Gallegos, Ocos, Guatemala, Central America.

An Adhesive Cement.

Equal proportions of gum tragacanth and tapioca are ground together and heated with water at about 70° Fah., after which there are added about 50 per cent of gum hog and an equal amount of starch, and the whole mixture heated at from 70°—120° Fah. The cement thus produced is said to be superior to any hitherto known for the requirement of silk and cotton manufacturers, calico printers, book binders, hat and boot makers, etc.

AN IMPROVED BALANCED SLIDE VALVE.

The valve shown in the illustration, recently patented by Mr. George S. Neeley, of Pacific, Mo., is of very simple and durable construction, and is designed to reduce the friction to a minimum and utilize the steam to the greatest advantage. Fig. 1 is a sectional view showing the valve in position on a steam chest, Fig. 2 being a plan view. The ports of the valve are moved by the valve stem to alternately connect with the ports at either end of the cylinder, the valve ports diverging from a common port registering at all times with a port in a plate held loosely on the top of the valve. On this plate is a hollow piston fitting steam tight in a cylinder in the cover of the steam chest, the upper end of the cylinder being closed by a cover through which extends the steam supply pipe, while on the under side of the cover is a spring pressing on the hollow piston, to hold it in contact with the plate. The area of the piston is about one-fifth more than that of the port in the plate, and, while all the steam passages are very direct, it is designed that, by the interposition of the plate between the hollow piston and the slide valve, the latter will be sufficiently counterbalanced to insure easy running, with the least possible friction.



NEELEY'S BALANCED SLIDE VALVE.

© 1893 SCIENTIFIC AMERICAN, INC.

The Malleability of Iron.

The mill manager of Messrs. W. Hallam & Co., of the Upper Forest Tin Works, near Swansea, succeeded in making a sheet of the finest appearance and thinness that has ever yet been seen by mortal eye. The iron from which the sheet was rolled was made on the premises. It was worked in a finery with charcoal and the usual blast; afterward taken to the hammer, to be formed into a r gular flat bottom; from thence conveyed to the balling furnace, and when sufficiently heated taken up to the rolls, lengthened, and cut by shears into proper lengths, piled up, and transferred to the balling furnace again; when heated it was passed through the rolls, back again into the balling furnace, and when duly brought to the proper pitch was taken to the rolls, and made into a thoroughly good bar.

It was then taken to the tin mills and rolled till it was supposed to be thinner than 23 grains, afterward passed through the cold rolls to give it the necessary polish, and it stands on record as the thinnest sheet of iron ever rolled. The sheet in question was 10×5½ inches, or 55 inches in surface, and weight but 20 grains, which being brought to the standard of 8×5½ inches, or 44 surface inches, is but 16 grains, or 30 per cent less than any previous effort, and required at least 4,800 to make one inch in thickness.—*Paper Maker's Journal, England.*

Great Circle Sailing.

The advantages to be derived from sailing upon the arc of a great circle are described in the North Atlantic Pilot Chart for July, issued by the United States Hydrographic Department, as follows:

It is too common a practice among mariners to accept the straight line of the Mercator chart, *i. e.*, the rhumb line, as a direct route. The rhumb line, in itself, offers the single advantage of a true course (technically, so called) which is constant; but this is more an imaginary than a real advantage, because the true course must frequently be corrected for the magnetic variation, and the original rhumb is never strictly maintained over long distances.

Although the chart serves to direct a vessel's course and to mark her progress, the vessel herself actually sails upon the surface of the sphere. When her course is shaped by the rhumb, she approaches her port in a roundabout way, in reality never heading for her port until it is in sight. The rhumb line of the sphere is a spiral, which has the property of making a constant angle with the meridians. Upon the Mercator chart it projects as a straight line, and thus presents a false appearance of minimum distance.

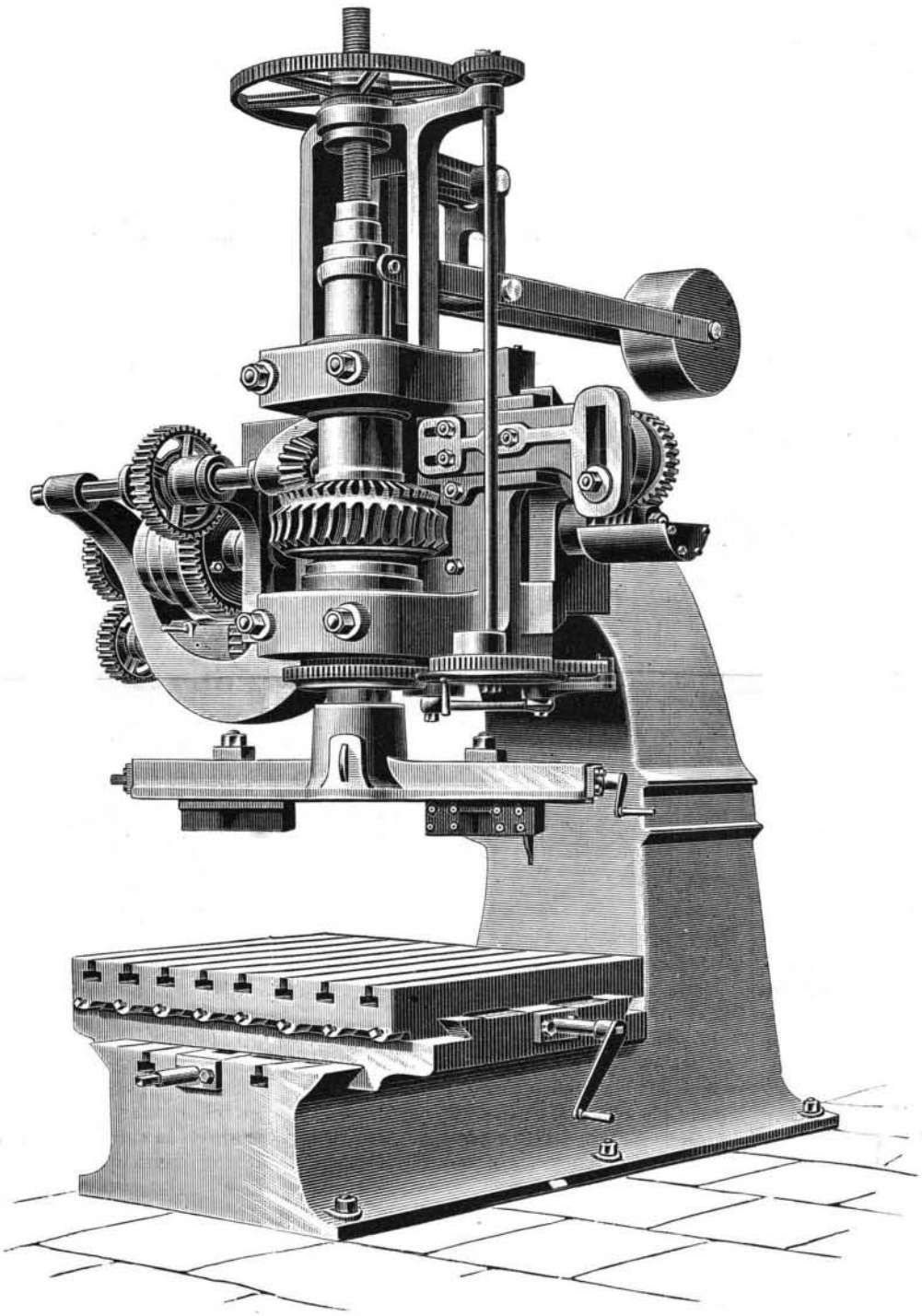
A glance at a globe, or at a thread stretched across its surface, makes it apparent that the shortest distance between any two places upon the surface of the sphere is along the great circle which joins them, and that it is only while maintaining her great circle course that the vessel heads for her port as if it were constantly in sight. Except when sailing along a meridian, or the equator, the true course upon a great circle changes gradually with the advance of the vessel, but so slowly that in practice a new course need be set only for each 100 or 200 miles of distance made good. Since the great circle course for any position of the vessel is quickly found, the necessity for a change of course may be easily investigated.

When a great circle route is to be taken, the whole route should be projected upon the sailing chart, either by a continuous line or by frequent points, that it may be examined for general direction, obstructions, meteorological conditions, etc. When a vessel falls off the original great circle, she should not attempt to regain it, for the shortest distance then is upon the great circle that joins her position to her place of destination. Her course is always the great circle course at her actual position. In general, it will suffice for sailing vessels to shape courses as usual, following the general direction of the original great circle as projected, but it is preferably for fast steamers to ascertain the exact great circle courses. From what has been said it is seen that a vessel, in pursuing a great circle route, practically sails upon a series of short rhumbs closely approximating a great circle.

The distance saved by a great circle route, as compared with a rhumb route, varies greatly, according to conditions. Between Yokohama, Japan, and Cape Flattery, Washington, it is 268 nautical miles; from Belle Isle to Malin Head it is only 36 miles, the total distance being only 1,692 miles.

IMPROVED CIRCULAR AND ELLIPTICAL BORING MACHINE.

We illustrate from *Engineering* a circular and elliptical boring machine constructed by Messrs. G. & A. Harvey, Albion Works, Govan. On the upper surface of the main frame or standard, which is of box section, there is bolted a slide or bed having planed V's and carrying a belt, cone and spur-driving gear. On the front of the bed there is fitted a saddle with a bearing for a sleeve, through which passes the boring spindle, which is 8 inches in diameter. On this sleeve a worm and bevel wheel are securely fixed, the former gearing into a bevel pinion on the end of the spur wheel shaft, the motion of either driving arrangement being conveyed direct from three-stepped cone or double gear, as desired. The spindle carries a double-ended tool slide having 8½ inches in vertical travel, the tool boxes of which are movable horizontally for boring diameters from 3½ inches to 60 inches. By using one tool box and giving motion along the slide to the saddle by means of worm, worm wheel, disk and connecting bars, holes may be bored varying from a complete circle to those of an elliptical form, whose transverse and conjugate diameters have not more than a difference of 7 inches. The spindle is counterbalanced by lever and weight, and has 14 inches vertical travel by hand or self-acting feed when the double-ended slide is removed. On the upper tool slide there is fitted a compound table adjustable by hand by means of screws. The upper table is furnished with T-slots for securing the work required to be operated upon.



IMPROVED CIRCULAR AND ELLIPTICAL BORING MACHINE.

BY mixing a saturated solution of carbonate of soda with ordinary carmine ink, red lines may be successfully drawn on blue prints.

Practicability of Increased Tractive Power on the New York Elevated Railroad Structures.

The experience of the "Alley" elevated road in Chicago shows very conclusively, says the *Railroad Gazette*, that six, seven, and even eight-car trains are readily handled, so far as loading and unloading are concerned, whenever the platforms are made of suitable length. This is practically a demonstration that the capacity of existing elevated roads can be increased materially by hauling a greater number of cars at the hours when more capacity is needed.

In Chicago, for instance, the number of trains that can be sent out from Congress Street in an hour is limited to the delivery of a single stub terminal. The headway so far has been about 2½ minutes. With a six-car train this accommodates about 500 passengers each 2½ minutes, or 14,400 passengers an hour. With eight-car trains it would be 19,200 passengers an hour. The only extra cost of hauling the greater number of passengers lies in the increased number of guards on the trains and some additional expense for fuel. The increased fuel used is not in proportion to the increase in train, being much less; so that the total train expense per passenger is materially decreased by using the longer train. The result then is a decrease in train expense per passenger, and increase in total capacity by using more cars per train.

To make the same time over the road this requires a heavier engine, as elevated railroad motors are, as a rule, worked to their full capacity. In Chicago their capacity is about seven cars per train. So far as the structure is concerned, it is not strained practically any more by a longer train than by a short one, except perhaps on curves; but as the trains are allowed to float around the curves at a slow speed, probably no greater strain would be produced there. The limit of train length with the present form of steam motor lies in the limit of weight that can be made available for adhesion on the locomotive. The locomotives in New York weigh about 47,000 pounds; in Chicago about 58,000 pounds. If all of the weight of the Chicago engines could be made available for adhesion, the locomotives would be sufficiently powerful to haul at least nine cars per train. The steam supply is quite sufficient on those engines for the increased work that would be demanded. As the engines are designed, they have trucks under the tank which carry about 18,000 pounds, or nearly one-third of the total weight. This weight is useless for adhesion, and is, in fact, a dead weight that has to be carried without serving any really useful purpose.

This explains the preliminary facts relating to the point we wish to bring out, which is that the existing elevated railroad structures could be made to carry much longer trains by a proper arrangement of the weight of the locomotive. Before radical steps are taken, if ever they are, to modify existing structures of elevated roads, it should be seriously considered whether longer trains would not be more profitable than the five-car trains now run.

Sudden Death to Flies.

"Come inside a minute," said a Fourth Avenue dealer in pianos, yesterday afternoon. "I have discovered the greatest fly trap on earth and I want to show it to you." He led the way to an instrument at the rear of the store on which was a newspaper. On the paper had been placed a bunch of sweet peas. At least a thousand dead flies were lying on the paper in the immediate vicinity of the bunch of flowers. "I threw these here by chance," he continued, "and in about ten minutes I happened to notice that every fly that alighted on the flowers died in a very short time." Even as he spoke a number of the insects which had stopped to suck the deadly sweet had toppled over dead. They alighted with their usual buzz, stopped momentarily, quivered in their legs, flapped their wings weakly several times, and then gave up the ghost.—*Louisville Journal.*

© 1893 SCIENTIFIC AMERICAN, INC.

Carbonizing Metal.

One method used in Germany for introducing carbon into a molten metal bath is by mixing pulverized anthracite and lime water together, and forming the mass in briquettes under great pressure, these briquettes being then brought into contact with the molten metal; in this way, exactly, the desired proportion of carbon for the formation of steel of various tempers and qualities can be imparted to the converter. The method of recarbonizing is stated to cost only about one-sixth that of the ferro-manganese plan, but the most important advantage presented is the greater accuracy and uniformity with which any required quality of steel may be produced, ranging all the way from the hardest to the very toughest sorts. It is anticipated that rails made according to this new system will have a life of from 35 to 40 years, while girders made in this way possess very great additional durability.—*Iron Trade Review.*

Xylolith or Wood Stone.

Xylolith, or wood stone, says the *American Architect*, is coming into extensive use in Germany. A recent number of the *Bautechniker* gives a variety of additional particulars. Xylolith, or steinholz, or wood stone, is made of magnesia cement, or calcined magnesite, mixed with sawdust, and saturated with a solution of chloride of calcium. The pasty mass, before the cement sets, is spread out into sheets of uniform thickness, and subjected to an enormous pressure, amounting to more than a thousand pounds to the square inch. The compressed sheets are then simply dried in the air. The original invention of this material dates back to 1883, but it is only within the last five years that a single firm, that of Otto Sening & Co., at Pottschappel, near Dresden, has undertaken the manufacture of it on a large scale, and has met with such success that it is already engaged in the erection of extensive additional works in the Austrian territory, to supply the South German market. In 1888, a series of tests of xylolith was made at the royal testing station for building materials in Berlin, covering its chemical as well as mechanical qualities. In resistance to tension it was found, naturally, that the dry material was much superior to the same soaked with water, dry specimens resisting a tension of about 100 pounds per square inch, while pieces saturated with water resisted only two-thirds as much. Soaking the dry material in linseed oil increased the tensile strength about ten per cent, and freezing diminished it slightly. The resistance to compression proved to be about 300 pounds to the square inch. This was diminished about ten per cent by freezing, and increased to about the same extent by careful drying and saturation with linseed oil.

The specific gravity of the new substance was found to be 1·553. The fractured surfaces showed a yellow color, with a perfectly uniform and close grain. When immersed in water, unbroken sheets of perfectly dry material took up 2·1 per cent of their weight of water in twelve hours and 3·8 per cent in two hundred and sixteen hours. Broken pieces absorbed in the same time about twenty per cent more water than the unbroken sheets. To try the resistance to the influences of the weather, a large number of samples were taken, and subjected to boiling in water, brine, soda-lye, hydrochloric acid, and solutions of sulphate of iron, sulphate of copper and sulphate of ammonium, alternating the boiling with sudden cooling. After several days' treatment with hydrochloric acid a loss of 2·3 per cent in weight was observed, but the properties of the pieces under test were not perceptibly affected. In the other cases no loss of weight could be detected, nor was there any other apparent alteration, and the liquids used for treating the samples remained perfectly clear. Exposure to superheated steam, in a Papin's digestor, also produced no visible effect. In hardness, the material was found to occupy a position between feldspar and quartz, being scratched by the latter, but not distinctly so by the former. As a conductor of heat, the xylolith was found to rank between asbestos and cork, being, therefore, one of the best non-conductors known. To test its fire-resisting qualities, sheets were exposed for three hours to the flame of a Bunsen gas burner, by which the actual surface touched by the flame was charred, although there was no crumbling, or extension of the charring beyond the marks of the flame. Similar pieces, laid on the burning coal in the fire box of a drying oven, and kept for some time at a red heat, were rendered brittle, and crumbled at the edges, but kept their shape and cohesion, and showed no sign of breaking into a flame.

For use, xylolith is delivered in sheets, from a quarter of an inch to an inch and a half thick, and of all sizes, up to a meter square. The dimensions are almost unchangeable by dryness or moisture. A sheet measuring one meter square when perfectly dry will expand from one to two-tenths of one per cent when soaked in water, and a moist sheet will contract in drying to about the same extent. Being so little subject to contraction and expansion, it is extensively used for floors in railroad stations, hospitals and similar buildings, and for decks of vessels. It is readily planed, sawed, bored and fashioned with ordinary wood working tools, and may be painted or decorated in the same manner as wood. It is itself nearly waterproof, and with suitable putty in the joints, and a good coat of paint, it may be made entirely so. It is not surprising that a material possessing so many advantages should have come into extensive use abroad, and we trust that its manufacture may be introduced here. It is sold in Germany, in sheets of thickness suitable for flooring, at abont seven cents per square foot, and the laying costs, complete, about four cents more.

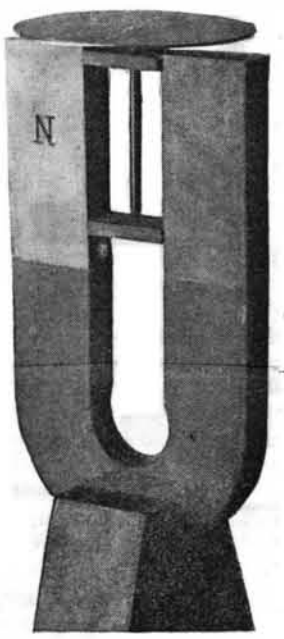
EXPERIMENT SHOWING MAGNETIC LAG.

BY GEO. M. HOPKINS.

Most students of electricity know theoretically what is meant by magnetic retardation, or magnetic lag, and electrical engineers and manufacturers of electrical machines understand the causes and effects of this action in the armatures of dynamos and motors; but to most people, and especially to students who really desire to fix an idea in their minds, an experimental demonstration is more valuable than any amount of theory.

It is of course impossible to see what goes on in an armature while moving, but it is known that the armature core becomes a magnet by induction, and that its poles are of the opposite name to the adjoining poles of the field magnet. It is also known that time is required for the magnetization and demagnetization of the armature. The time element is thus seen to be one which cannot be left out of the calculation in designing dynamo-electric machines.

A very simple experiment, which helps to an understanding of what magnetic lag is, is shown in the annexed engraving. A perforated block is inserted between the polar extremities of a U-magnet to receive a pointed spindle attached to a soft iron disk held near the poles of the magnet. The pointed end of the spindle rests upon a cross bar inserted between the arms of the magnet. The disk, which turns very freely, absorbs the magnetic lines and becomes strongly magnetic. When the disk is at rest, poles are developed in the disk in front of the poles of the magnet, but when the disk is turned ever so little, the poles in the disk are carried forward in the direction of rotation. This is proved by the action of the disk when it stops. It immediately moves a short distance in a retrograde direction, showing that the points of greatest magnetic density in the disk lie beyond the poles of the magnet in the direction of the rotation of the disk, and that these points are attracted toward the magnet poles. Owing to the friction of the bearings of the spindle, and to the almost immediate readjustment of the magnetic lines in the material of the disk, the return movement does not represent the entire lag, but it shows in a striking manner what lag is.



EXPERIMENT SHOWING MAGNETIC LAG.

The Next World's Fair.

It is announced that the next World's Fair will be held in Antwerp in May, 1894. The Antwerp Exposition will be much smaller than the World's Fair at Chicago. Antwerp has the advantage of being able to take exhibits directly from the vessels in which they are transported, as the river Scheldt will float vessels of 8,000 tons burden. Antwerp is readily reached in a few hours from Paris and all parts of Belgium, Holland, and the Rhine provinces of Germany. London and Antwerp are only eight or nine hours apart by the Harwich route or the Ostend route, while Antwerp is directly accessible from the United States by the Red Star line, which furnishes first-class accommodations at moderate rates. In Belgium there is no hostility to government appropriations and no municipal prejudice. There will be no sandbagging by the railroads, and it is to be hoped none of the disgraceful wrangles which have characterized our Fair. Although there is not the slightest possibility that the Antwerp Fair can compare with ours, still when Paris celebrates the opening of the new century in 1900 it is probable that the Chicago Exposition will be equaled if not surpassed.

Already the French engineers are making preparations for 1900, plans are being made for the railroads which are to convey the passengers to the Bois du Boulogne, for while the Champs de Mars has not grown smaller since 1867, the size of international expositions has increased.

Blue Focusing Glass.

Photographic Work says: A blue focusing screen has been suggested as eliminating the effect of color in the case of the camera image, and so enabling the photographer to better judge as to how his work will look; the colors of a landscape often giving a charm to the scene which is not realized in the photograph.

It is suggested to wash over the ordinary ground-glass screen with an alcoholic solution of an aniline blue; but in this case the screen could not be readily cleaned. Hence a much better course would be to fine-grind a piece of blue glass.

It is very easy to make a fine ground focusing screen by using the finest emery of the shops—sold as "flour emery." This should be mixed with water, and worked on one surface of the glass with a rubber consisting of a piece of thick plate glass about an inch square. The progress of the work can be seen by rinsing the emery off, when special attention can be given to any imperfectly ground parts. It is obviously desirable not to scratch the back of the plate, and to insure this the plate should be held steadily on a flat surface while the rubber or muller is being used. A flat-topped bottle stopper often makes a convenient muller.

The August Meteors.

Happening to be in Ithaca, N. Y., on the night of August 10, I watched for Perseids from 10:20 P. M. until midnight, 75th meridian time. With the exception of about three minutes, I kept my face directed toward the radiant point of the meteors during the entire interval of an hour and forty minutes. The sky was cloudless, but covered with a light haze, which slightly dimmed the fainter stars. I counted forty-five meteors. Of these, thirty-five were plainly Perseids. All but one of the others traveled in approximately parallel paths from near the square of Pegasus toward or across Andromeda. None moved in any other direction except one rather large meteor, which shot from west-southwest, passing overhead about 11:45. It should be said that my view toward the west as well as toward the south and southeast below the square of Pegasus was shut off by neighboring buildings and trees, so that if any meteors appeared in those quarters moving from Pegasus as a center, I could not see them. All of the meteors just described as not traveling from the Perseid radiant were, with the exception of the one seen overhead, small and swift-moving.

A few of the Perseids were as bright as first and second magnitude stars and left beautiful though evanescent trails. These bright meteors had a distinct reddish tint. One of them, which shot straight across underneath the Pole star at 10:45, was at least as bright as Sirius. Its visible path was not less than 20° in length. It was yellow bordered with a flare of red, but at the moment of extinction these colors were swallowed up in an outburst of white and vivid green. After its disappearance a greenish white train, five or six degrees long, remained visible along the latter portion of its track for half a minute. This train undulated rapidly like a ribbon streaming in the wind, and gradually shrunk and faded until it vanished, when a fourth magnitude star suddenly made its presence manifest at the poiut where the last shred of the meteoric train had been seen. The star had not been noticed when it was behind the train.

At about 10:55, while my eyes were fixed in the direction of the radiant, a faint stellar object made its appearance a few degrees northeast of Chi Persei, and quickly brightened until it equaled a third magnitude star, when it vanished. It was evidently a meteor coming "end on" toward my eyes. I had a distinct impression that its light appeared drawn out into an excessively brief trail, like a short dash in the Morse alphabet, which would indicate that the meteor was not moving exactly in the line of sight. But the deviation was so slight that I could form no accurate estimate of its amount. The point where this meteor appeared was, by estimation based on a subsequent consultation of a star chart, in right ascension 2 h. 50 m., declination north 58°.

About half an hour before beginning my watch I saw three Perseids within two minutes. Two of them were large and reddish, making conspicuous trails. They appeared not more than fifteen seconds apart. Both started from near the radiant point and they moved in paths almost exactly at right angles to one another. The effect was surprising and beautiful.

It seemed to me during my watch that the larger meteors showed a gregarious tendency. If one appeared after a long interval, during which only small ones had been visible, it was almost invariably followed within a short time by another of more than ordinary size and brilliancy, but not traveling in the same direction across the sky. Afterward again only small ones were seen for a considerable time.

GARRETT P. SERVISS.

IT is estimated that about 250,000 canary birds are raised every year in Germany. The most important market is the United States, which take about 100,000 birds per annum.

© 1893 SCIENTIFIC AMERICAN, INC.

NASMYTH'S TORPEDO BOAT OF 1853.

More than forty years ago, to wit, February 19, 1853, the SCIENTIFIC AMERICAN published illustrations of James Nasmyth's torpedo boat, which presents several features of novelty, and we have thought it of sufficient interest to our readers to reproduce the description and illustrations as originally given by us. Peculiar interest attaches to this submarine boat of nearly half a century ago from the fact that a selection is soon to be made, by a board of examiners of the Navy Department, of a type of submarine vessel, for the construction of which Congress has appropriated $200,000. Some fifty or more proposed plans have been examined, and the selection has, it is stated, been narrowed down to a choice between the Baker and the Holland types, the former of which has had some trials on the Detroit River and the latter in the waters near New York City. Both of these submarine boats have been illustrated and described in the SCIENTIFIC AMERICAN; the Baker boat, July 30, 1892, and the Holland boat experimented with also by Lieut. Zalinsky, August 7, 1886. The following is the description:

"The annexed engravings are views of a floating, partly submerged propeller, torpedo vessel, proposed by James Nasmyth, of Patricroft, England, for destroying large ships of an invading fleet. Fig. 1 shows the floating mortar, steered by the man at the sight hole, X, and shown attacking the enemy. Fig. 2 is an enlarged view of the great brass mortar and shell. The cap, C, explodes the instant it is brought in contact with the breech, R; this it does in consequence of the protruding end of the shell being crushed against the side of the enemy. The flange, S S, is just so strong as to resist any ordinary pressure, and is thereby made safe till crushed back by contact with the side of the enemy.

"Fig. 3 is a transverse section of the mortar.

"Mr. Nasmyth is the inventor of the steam hammer, which bears his name, and various other useful inventions, and, besides, he is a first-rate astronomer and mathematician. The following is his own account of the invention, which was sent to the *Illustrated News:*

"The principles on which the arrangement and construction of the floating mortar is based consist, in the first place, of a monster self-exploding shell, so arranged as to explode on having its breech end crushed against the breech of the mortar, the self-exploding cap being situated there, as will be seen on reference to the engraving.

"In order to enhance the destructive effect upon the enemy's ship, the shell is so far submerged as to tear its way into the enemy six feet under water line.

"Next, to protect the shell from the effect of the water while resting in the chamber of the mortar, it is rendered waterproof by being inclosed within a perfectly watertight copper case, which will so effectively

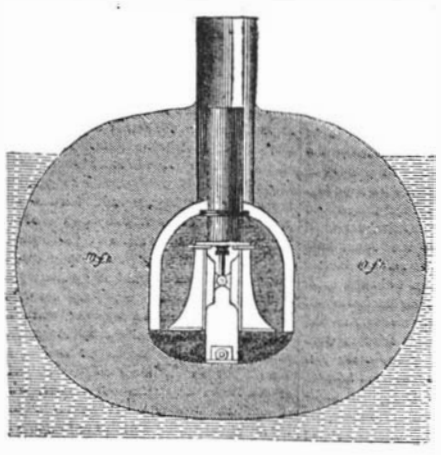


Fig. 2.

secure it from the action of the water as that it may remain, if need be, for years in the chamber of the mortar, submerged, as before said, six feet under water line, and ready for service at any time.

"The crush consequent on coming in contact with the side of the enemy is the agent whereby the monster shell is made to explode. A very moderate velocity of the floating mortar would, when brought up against the side of the enemy, prove sufficient for this purpose; so much so, that, in order to obviate the chance of its explosion by accidental contact with any other object, I have so placed the flange joint of the copper case against the mouth of the mortar that the crush against the side of the enemy, resulting from a speed of two or three miles per hour, shall be sufficient to overcome the resistance of this flange, and crush the self-exploding cap at the breech end of the shell against that of the mortar, and so cause it to explode and tear its fearful way through the side of the enemy. Thus it will be evident that we can never fail to render the shell effective, inasmuch as that it is the very fact of contact with the side or hull of the enemy that brings the self-exploding agency into action. No ship that has ever been built, either wood or iron, could survive the fearful hole which a monster shell, exploded under such circumstances, would produce.

"The next feature is the intimate union of our mortar with the hull of the screw steam vessel, which

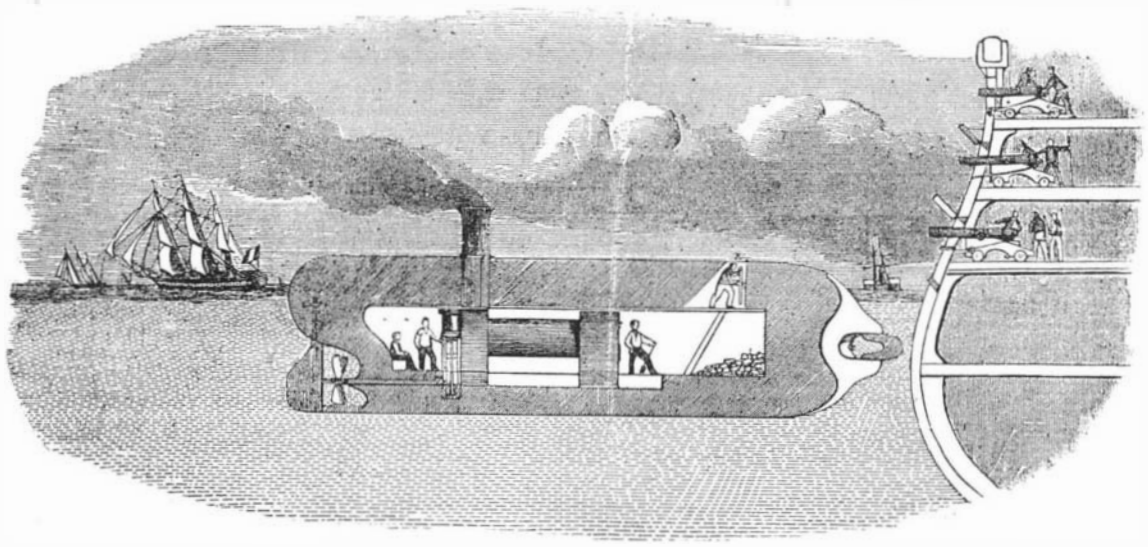


Fig. 1.—NASMYTH'S TORPEDO BOAT OF 1853.

transports it direct to the object which we desire to destroy. The mortar is (as will be seen on reference to the engraving) made part and parcel of the vessel, and so situated as to unite the most effective mechanical arrangement with the strongest position of the vessel, viz., 'end on,' so that the entire mass of our vessel (mortar and all) is brought into play, as the means whereby the concussion or recoil due to the explosion of the shell is absorbed by the entire mass of the floating mortar, so that no sensible recoil or concussion would be experienced.

"Next is the manner in which the crew who attend to the navigation of the floating mortar, together with the steam engine, boiler, and screw, are protected from the action of shot, whether red hot or cold. This object is attained by giving the vessel, in all directions where assailable, such a thickness of timber as that no shot, of whatsoever description, can penetrate to the interior. To insure this, the hull of our floating mortar will be made at least ten feet thick, of poplar wood, which material is admirably adapted for the purpose, by reason of its lightness, toughness, and incombustibility. Red hot shot might lodge in it, but would fail to set it on fire. A red hot shot would only char a few inches of the timber around it and cool at its leisure, and from the extent to which the hull would be submerged, the portion above water presents no surface favorable for the effective action of shot; while, as there will be most ample accommodation in the interior for a high pressure engine and boiler, with direct action screw propeller, there is nothing to prevent our obtaining a velocity of eight or nine miles an hour, although for the actual objects of the vessel a speed of five or six miles would be ample. The draught of the engine furnace would cause perfect ventilation for the crew, which need not consist of more than three or four handy men.

"I would observe, in conclusion, that as this class of vessel is chiefly designed for defense against invasion, and would not have to act against an enemy, probably, at greater distances than one or two miles from our shore, it could speedily return for another shell; the means for lodging which in the chamber of the submerged mortar are most simple, but not needful at present to describe. I conceive, however, that the total destruction of one enemy's ship at each trip would be sufficient service.

"Three or four such floating mortars, each of which sending to the bottom of the sea the largest ships an invading enemy might dare to bring toward our shore, would make such a demonstration as would strike terror into the largest fleet that molested a peaceful nation; and not fail to confirm the maxim, that the best way to prevent war is to render the results so terrible as that evil-disposed nations will think twice ere they face such wholesale destruction as our floating mortars would not fail to deal out to them.

"The fear of an invasion has been very strong in the minds of the people of Britain ever since Louis Napoleon became President of France, and at present the excitement, we can perceive, is approaching fever heat. It was said once that, 'A sight of the gray coat of Napoleon (the great we mean) was enough to set all Europe in an uproar.' We must say that England seems afraid now in trusting in her wooden walls, and, instead of terrifying her foes by keeping watch and ward on their coasts, as she once did, she is keeping a sharp lookout for the defense of her own coasts by such water hogs as this of Mr. Nasmyth. Prudence, no doubt, is the better part of valor, but we apprehend that this vessel could very easily be taken prisoner by a few boats before it was permitted to drive its snout against the side of an invading war ship. It, no doubt, could be used at night as well as during daylight; but at the same time, we must say that since Mr. Nasmyth has brought this subject before the public, invading ships will be prepared for it, as they now understand what it is. Torpedo submarine vessels are not new; more than one has been invented in America, and for many years they formed a more interesting subject to Robert Fulton than his steamboat. He was furnished with means by Napoleon to blow up an English frigate, but failed, and after that Napoleon seemed to entertain a prejudice against him. Lord Cochrane invented a torpedo submarine vessel, but nothing of any consequence, so far as we are informed, resulted from it, and never will, we suppose."

Genuine Vinegar.

In the British Pharmacopœia, *The Analyst* says, vinegar is defined as "an acid liquid, prepared from a mixture of malted and unmalted grain by the acetous fermentation." The specific gravity is from 1·017 to 1·019, and it is to contain about 5·41 of real acetic acid ($C_2H_4O_2$).

The vinegar of the German Pharmacopœia is required to contain at least 6 per cent of absolute acetic acid. In Russia the minimum limit of strength is 5 per cent; in Austria, 6; in Belgium, 5·6; in France, 8 to 9; and in the United States, 4·6 per cent.

In 1874 the Society of Public Analysts adopted 3 per cent of real acetic acid as the minimum limit of strength for vinegar.* This limit certainly cannot be said to err on the side of too great stringency, and there have been very few prosecutions for the sale of vinegar containing less than this very moderate proportion of acetic acid.

With regard to the sale of vinegar, the pharmacist stands in a far more delicate position than the general dealer, for it might be argued, with some plausibility, that, when purchased of a registered pharmacist, an article recognized in the British Pharmacopœia ought to comply with the description of it given by that authority. This would limit the "vinegar" to be sold by pharmacists to the very best quality of malt vinegar; and if the B. P. definition of vinegar were legally applied to-day, a considerable proportion of the trade would probably be caught tripping.

With the single exception of Brannt, who appears to hold that vinegar may be legitimately manufactured from wood acid, while admitting that the product is inferior to the fermentation acid, all the authorities above quoted agree in regarding true vinegar as an

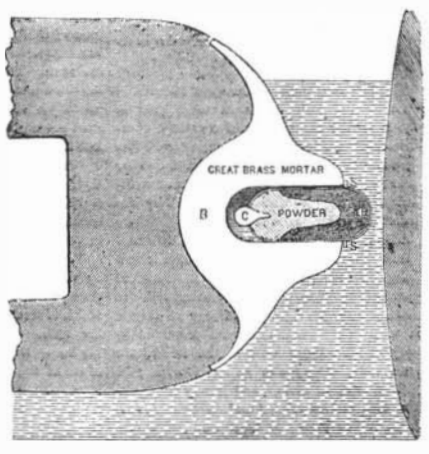


Fig. 3.

acid liquid produced by the acetous fermentation of alcoholic liquids, and consequently regard acetic acid from wood as not answering to the description of genuine vinegar.

IT is said a female codfish will lay 45,000,000 eggs during a single season. Piscatorial authorities say that were it not for the work of the natural enemies of fish they would fill all the available space in the seas, rivers, and oceans.

* By the term "real acetic acid" there is good reason to believe that acetic anhydride was intended. Three per cent of $(C_2H_3O)_2O$ corresponds to 353 per cent of $(C_2H_3O)OH$.—A. H. A.

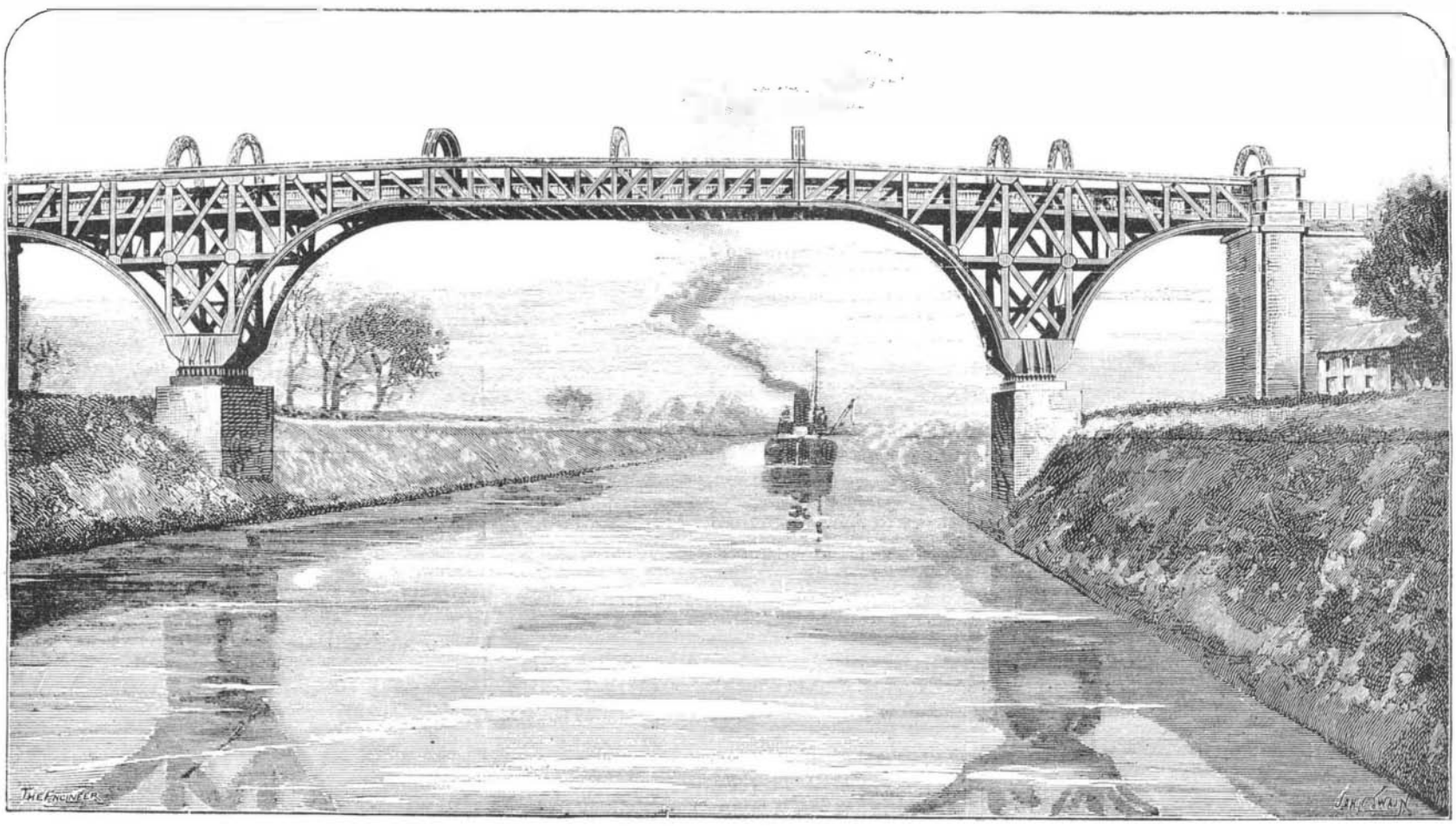
© 1893 SCIENTIFIC AMERICAN, INC.

WARBURTON ROAD BRIDGE—MANCHESTER SHIP CANAL.

We present herewith an illustration of the Warburton Road bridge over the Manchester Ship Canal. The canal was constructed to enable sea-going vessels to reach Manchester, and thus avoid expensive railway transfers of freight at Liverpool.

The Manchester Ship Canal is 35½ miles long, 26 feet leep, and 120 feet wide at the bottom. Docks are built at intervals to accommodate the largest vessels which traverse the canal. The docks at Runcorn, Salford, and Manchester are very extensive. The total capital stock of the company is £9,812,000.

Engineering works, as locks and bridges, were necessitated by the country which the canal traverses and the exigences of travel, and these works required the skill of the best civil engineers. The most important problem connected with the scheme, next to the cutting of the canal itself, was the providing for the traffic which exists between the two sides of the river Merseyand the Irwell. Four roads cross the canal, one at Barton, one at Warburton, and two at Warrington. In addition to the road bridges, the Bridgewater Canal and five railroad bridges, as well as the famous Runcorn Viaduct, cross the canal. In the final plans, swing bridges were abandoned and high level bridges were substituted. The Warburton Road bridge was designed by Mr. E. Leader Williams, M. Inst. C. E., and is a fine example of a cantilever bridge. For the illustration we are indebted to the *Engineer*. The Manchester Ship Canal



MANCHESTER SHIP CANAL—WARBURTON ROAD BRIDGE.

is described and illustrated in the SCIENTIFIC AMERICAN SUPPLEMENT, Nos. 383, 515, 555, 685, 715, 763.

Pork Pie Poisoning.

The recent extensive outbreak of poisoning n Camberwell has revealed a little-suspected danger that may lurk in the pork pie *et hoc genus omne*. The outbreak was peculiar in two respects. The symptoms did not come on till after a lapse of from twenty-four to thirty-six hours, and those who scarcely tasted the pies suffered almost as severely as those who indulged freely. One woman, indeed, who had taken none, was attacked; but it was found that she had used a knife with which a pie had been divided.

In ordinary ptomaine poisoning the symptoms come on almost immediately, and their severity is, of course, directly proportionate to the amount of food taken. Here neither of those conditions was fulfilled, and the facts permit of but one interpretation. The pies were, so to speak, only potentially poisonous. They did not contain an actual chemical poison, but they did contain living bacteria, capable of growing in the body, and of producing deadly toxines therein. The period that elapsed before the onset of the symptoms was, no doubt, the incubation period of the bacteria, and with the enormous power of reproduction possessed by these organisms it mattered little whether many or few were introduced.

The pies, it is said, were made in Leicester on a Thursday, and sold either on the following day or on Saturday, and no complaint was made by any of those who partook of them that they were otherwise than perfectly fresh and good. This is exactly what we should expect, for there is no presumption that the meat of which they were made was bad. Indeed, the contamination must have taken place after they left the baker's oven. The ptomaines of decomposed meat may pass through the baking process without change; but it is hardly possible to suppose that living bacteria could survive such an ordeal.

This, then, is a matter entirely different from the ordinary ptomaine poisoning due to the use of bad meat, and it raises a question of considerable interest. The pork pie, be it ever so good and fresh, forms a most admirable culture medium for microbes, and when we think of the late revelations concerning the disgraceful sanitary condition of our bake houses, we cannot but wonder that outbreaks like that at Camberwell do not occur more frequently. Short of actual poisoning, however, we suspect that the question is one of no little practical importance to the public, that cooked meats are pretty often contaminated with bacteria, and that a large proportion of sick-headaches, summer diarrhœa, and the like are to be accounted for in this way.—*Chem. and Drug.*

Prehistoric Irrigation in Arizona.

In the July *Anthropologist*, Mr. F. W. Hodge gives some interesting notes on this subject, from which we take the following:

In none of the extensive archæologic remains of Southern Arizona are the industry, perseverance, and degree of advancement of a large pueblo population more faithfully illustrated than in the many works of irrigation that abound in the valleys and on the mountain slopes of this section.

Judging from the remai s of extensive ancient works of irrigation, many of which may still be seen passing through tracts cultivated to-day as well as across densely wooded stretches considerably beyond the present non-irrigated area, it is safe to say that the principal canals constructed and used by the ancient inhabitants of the Salado Valley controlled the irrigation of at least 250,000 acres, even without considering the economical methods employed by a primitive people in all its undertakings.

The mode of canal construction employed by these pueblo builders was another indication of their patience and industry. Their canals are models for the modern farmer to imitate; yet they could have been dug in no conceivable manner save by the laborious process of hand excavation with stone or wooden implements, the earth being borne away by means of blankets, baskets, or rude litters. Notwithstanding this, the outlines of at least a hundred and fifty miles of ancient main irrigating ditches may be readily traced, some of which meander southward from the river a distance of fourteen miles.

Unlike ordinary irrigation ditches, these were constructed in such a manner as to control to some extent the depth of the current as well as to prevent waste through seepage. The bed of the canal was about four feet wide, but the sides broadened in their ascent to within about four feet of the bank, where a "bench," three feet in width, on each side of the canal had been made. From these benches the banks continued, broadening until they reached the brinks, which were about thirty feet wide. Thus a main ditch consisted, so to speak, of one watercourse within another; so that if at any time a small current of water only could be supplied at the head-gate, owing, perhaps, to drouth, the lower and narrower ditch was doubtless always filled sufficiently to supply the towns beyond, while during the rainy season the upper and much broader portion of the great canal would readily accommodate all surplus waters.

Several years ago, when the Mormons first settled at Mesa City and began the irrigation and cultivation of the fertile plain about them, they utilized this ancient canal bed for a considerable distance, including that portion encircling the knoll of volcanic tuff mentioned. The writer has been informed by one of the founders of this settlement and builders of the Mesa canal, which is nine miles in length, that the saving to them by using the ancient canal was from $20,000 to $25,000.

In tracing the routes once pursued by many of the canals, great depressions—the sites of ancient reservoirs—are observable. The remains of one of these reservoirs, nearly a mile long by about half a mile wide, occur on the open plain at the terminus of one of the main canals that formed the source of water supply of Los Muertos, and about three miles southwest therefrom. It is possible that this great depression was, in part at least, a natural sink, deepened by artificial means to serve more fully the purposes of a storage basin of surplus waters from the Los Muertos irrigating system. Every cluster of communal structures in Los Muertos was supplied w th a reservoir on a smaller scale than the one just mentioned, a single canal forming both its inlet and outlet. Sometimes a lesser communal dwelling shared with a neighboring structure in the water supply from a single storage basin.

The Iron Industry.

President Richards, in his closing remarks before the British Iron and Steel Institute, said: "So successful have we all been in economically increasing production that we have inundated and swamped the markets for the time being; at present, and for some time past, there is not enough work for half the steel-producing power of the country. Thus we go on, and we look about in vain for new markets. We compare America with 60 millions of people, having 175,000 miles of railway, with India, having 250 millions of people and only 17,000 miles of railway, and wonder why, under our sway, it develops at such a wretchedly slow rate. Where is the trade to come from to keep our workmen employed and our establishments in operation? No one seems to be able to answer this question; but we know that we have had many serious depressions before, though none seem so deep, so prolonged as this. The iron and steel trades may be likened to Pandora's box, from which, once filled with all good things and all bad, everything escaped—the good things back to heaven and the evils to infest and plague the earth; but there is still left to us that which never deserts us, the inestimable blessing—hope."

© 1893 SCIENTIFIC AMERICAN, INC.

THE CENTURY VASE AT THE FAIR.

This most elaborate and highly finished representation of American art work in silver, valued at $25,000, and designed to commemorate the completion of the first century of the republic, forms a portion of the exhibit of the Gorham Manufacturing Company at the Columbian Exposition. Their display is in a pavilion at the beginning of the United States section, in the Manufactures and Fine Arts building, its main entrance being on the circle bounded by the four countries, the United States, Germany, England, and France. The vase is 4 feet 2 inches high, and its base is 5 feet 4 inches long, the weight of silver in it being 2,000 ounces. The pioneer and Indian on the front of the oval base suggest the first phase of life here, and at the extremities of the oval are festoons of native flowers. Above, on the left, is represented the genius of war, and on the right a lion led by children. The front panel of the vase, rising from the plinth, represents Genius ready to inscribe on the tablet the progress made in literature, science, etc., while surmounting the vase are four figures, the three subordinate ones representing Europe, Asia, and Africa, while the central and highest shows America inviting all nations to unite with her in an international exposition.

THE WORLD'S COLUMBIAN EXPOSITION—THE CENTURY VASE.

THE SANTA MARIA AT THE FAIR.

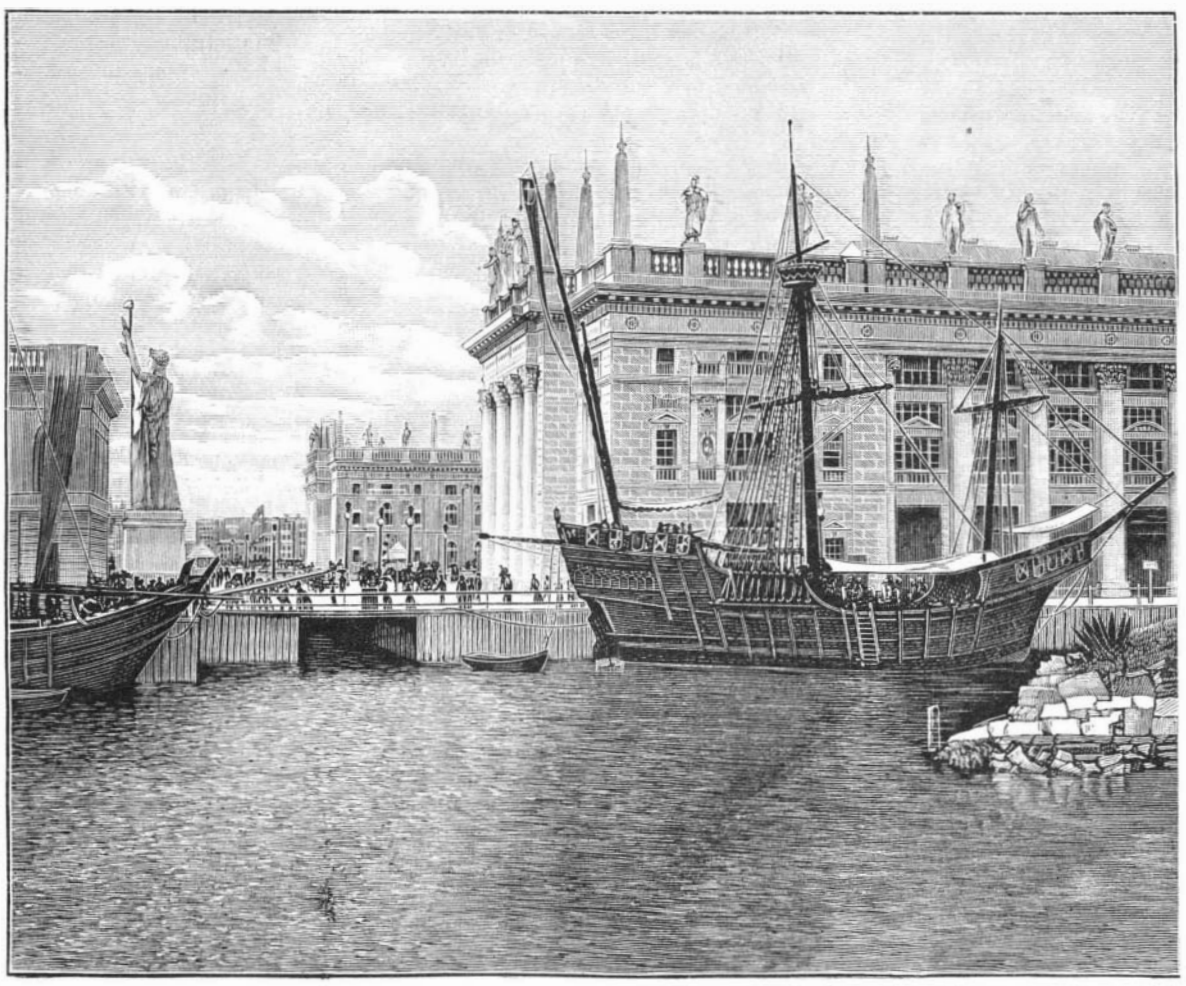
The principal vessel of the Columbus caravels, moored at her pier alongside of the Casino, has attracted constant attention ever since she became practically a portion of the great World's Columbian Exposition at Chicago. Crowds of visitors go aboard of the little craft every day, but the number of such visitors is small compared with the far greater number of those who simply content themselves with an outside view, on account of the multitude of other attractions which the Fair presents. In our view the Casino is seen nearest the vessel, the Music Hall beyond, and the statue of the Republic on the left.

The arrival at New York of the vessels built to faithfully represent the original squadron of Columbus, and the great naval parade and review in honor of the event, were fully described and illustrated in the SCIENTIFIC AMERICAN of April 29 and May 6. The Santa Maria, it will be remembered, is the largest of the three vessels of the squadron, but her greatest length is only 75 feet, width 23 feet, and burden from 120 to 130 tons. One would be counted a venturesome navigator who started in these days to cross the ocean in such a craft, and it is the vividness with which this idea presents itself to a visitor familiar with modern facilities for travel that constitutes the never-tiring interest the little craft has for so many thousands of sightseers.

The New Torpedo Boat Ericsson.

The first steel vessel ever built on the Mississippi is now nearly ready for launching, and her builders, the Iowa Iron Works, of Dubuque, propose to invite the governors of the States in the Mississippi Valley to be present. The Ericsson is guaranteed to have the highest speed of any vessel of our navy—24 knots. The Ericsson was built according to the act of June 30, 1890, and the contract price was $125,000. The motive power is derived from two coil or tubulous boilers, and is transmitted through two screws, one slightly in advance of the other, though not overlapping. The engines are two vertical, inverted, four-cylinder, quadruple-expansion, direct acting engines. The propelling and circulating pump engines have a combined horse power of 1,800. The torpedo tubes are for the new 18-inch Whitehead torpedoes.

THE Wilmot & Hobbs Manufacturing Company, of Bridgeport, Conn., has recently been awarded an important government contract for their cold-rolled steel for especially difficult stamped and drawn work. This steel, of which the company is now making a specialty, had been previously submitted to severe competitive tests, and is said to have well demonstrated its superiority.



THE WORLD'S COLUMBIAN EXPOSITION—THE SHIP OF COLUMBUS, THE SANTA MARIA, AT HER DESTINATION.

The Berliner Telephone Patent.

Not much has been heard recently, says the *Electrical Engineer*, of the government suit to annul the Berliner microphone patent. It is quite certain, however, that the case will not run on undertermined for seven or eight years, like the old and still unsettled suit to cancel the Bell patent of 1876. It is evident that the American Bell Telephone Company has a stronger motive for seeking dispatch than for securing delay this time. The Berliner patent is on a very different footing from that occupied by the Bell patent when it was attacked by the Department of Justice. That patent had been very thoroughly adjudicated and upheld by the courts, and the government suit went harmlessly on its leisurely course during the remaining life of the patent (and still goes on, although the patent is some months dead), forming no obstacle to the issuance of injunctions against infringers. But the Berliner patent, which on its face seems fundamental in respect to nearly all existing forms of microphone transmitters, has not yet had the judgment of any court as to its scope or validity. In its first ordeal it is put upon its defense under the attack of the Attorney-General. It is, therefore, not at all likely that its owners, the American Bell Telephone Company, will institute any infringement suits until it knows whether or not it has a sound patent.

A court would hardly take time to go into the question of infringement under the present circumstances of the patent. Moreover, the exceptional control of an entire art enjoyed by the Bell Company for seventeen years, because of the unprecedented scope of the Bell patent, which would have protected it against the use of the Berliner invention had it been in other hands, would probably be deemed by any court of equity a good reason for turning a deaf ear to any plea of urgency on the part of the Bell Company in dealing with an alleged infringer.

It is understood that testimony is now being taken in the government suit, and we have no doubt that any unnecessary delay in pushing the case to a conclusion will be chargeable to the Department of Justice rather than to the defendant.

THE decision of Judge Coxe filed July 18, 1893, affirming the expiration of the Faure storage battery patent in the United States, will not, says *Electricity*, make the manufacture of this type of accumulator in this country entirely free, as the courts have already construed the scope of this patent to include only the application of the active materials in the form of paste, paint or cement, while the Brush patent, which is yet in force, is broader and covers all forms of active material applied to the plates except where it is in the form of paint, paste or cement, or is formed from the material of the plate itself, as in the Plante type of cell. The decision, however, opens a field in this line of business in which considerable progress may be expected, and it will doubtless be taken advantage of by the manufacturers against whom injunctions have been procured by the company which controlled the Faure patent.

© 1893 SCIENTIFIC AMERICAN, INC.

WORLD'S COLUMBIAN EXPOSITION—ENTRANCE TO THE PALACE OF AGRICULTURE BUILDING.

The glory of the Exposition is the Court of Honor, and the glory of the Court of Honor is the Agricultural building. Situated on the south side of the great basin, it extends from the south canal nearly to the Casino, a distance of 800 feet. The building is 500 feet wide, and the cornice line is 65 feet above the grade of the walks. Architecturally the Agricultural building is one of the most successful in the inclosure. The architects were Messrs. McKim, Meade & White, of New York, who are so well known as the architects of the Madison Square Garden, in New York. The building is classical, and of an order designated as heroic by the architects. Pavilions are reared at each corner, and from the center of the building, the center one being 144 feet square. We illustrate one of the corner pavilions surmounted by a dome on which is a group of maidens of heroic size, called the Horoscope Group. These figures are represented as holding aloft a globe about which is a zone with the signs of the zodiac. The figures are made of staff, while the globes are of sheet copper. Each corner pavilion is surmounted by a group representing a distinct race, one the Caucasian, another the Mongolian, the third the Ethiopian, and the fourth the American Indian. Huge Corinthian columns 50 feet high and 5 feet in diameter support the pediment over the porticos. The dome over the main entrance, which is one hundred feet in diameter, is surmounted by St. Gaudens' statue of Diana, formerly in New York. On each corner pavilion are two reproductions of what are called the Four Seasons, making altogether eight of these groups. This group consists of four female figures representing the four seasons of the year, spring, summer, autumn, and winter. They are set back to back with their arms outstretched for sheaves of wheat extended above their heads.

We have already illustrated the large cattle group in our issue of April 29. From what has been said it will be seen that the decorative scheme of the Agricultural building takes its motive from agriculture, and primarily American agriculture; this is no less true when the minor decorative work is considered, maize, the potato, tobacco, etc., being freely used as decorative motives with excellent effect. The painted decoration in the entrance porticos is the work of Mr. George W. Maynard, of New York, who chose the Pompeian style of mural decoration as the best one adapted to the severely classic outlines of the Agricultural building. Mythological deities and figures representing "Abundance," "Fertility," etc., were chosen. The little bit of color adds greatly to the success of the general effect. We give some details of the other pieces of sculpture on this beautiful building, the description being taken from a former issue.

"On the exterior walls of the building, in strong relief, are fifty-four single figures of the Angel of Abundance holding a cornucopia which is overflowing with the fruits of the harvest. These figures are clothed in loose flowing robes and are classical like the others. Between the springs of the arches of the north, east, and west sides of the building are twenty-two more single figures in relief representing a female classically clothed, holding in her hands the signs of the zodiac. On the east front there are two spandrels, also two on the west and one on the north side. Four of these are the same. The two on the west side are immediately under the Horoscope Group and represent a pastoral scene of a shepherd with a crook in his hand, sitting on the right with two ewes and a lamb. The other spandrel represents the triumph of Ceres, and is on the north front. Ceres, the central figure, is represented as standing erect, holding a sheaf of wheat in her left hand and a shepherd's crook in her right. Further down on the pediment are other reliefs. On the left is a reproduction of Flora, Bacchus, and other mythological deities seated in a chariot drawn by two tigers. Over against this relief on the right hand is a figure of Mercury and pastoral deities in a car drawn by two dragons. The statuary is all the work of William Philip Martini, of New York, with the exception of Diana, which is the work of Mr. Augustus St. Gaudens."

The total cost of the building was $618,000, including the annex, which measures 312 by 550 feet.

In the interior thirty-seven States of the Union and thirty-five foreign nations exhibit agricultural products. Here may be found models of breweries with a capacity of one barrel of beer a day, exhibits of corn, maize, wheat and the complicated machinery used in their cultivation. Preserved meats, Apollinaris water, dairy products, sugar, bread, tea, coffee, spices, vegetable fibers follow one another in quick succession as the visitor hurriedly passes down the long avenues. Some of the oriental countries make choice exhibits, and here may be seen some of the possible uses of the bamboo.

In the galleries are attractive exhibits of well known food products, Quaker oats, Kingsford's starch and Maillard's chocolate and a thousand and one food preparations, with which we have been familiar from childhood, stare us in the face.

The exhibits are shown in a choice setting, and the marvelous beauty of the white building makes a lasting impression upon the memory.

Argentine or Silver Paper.

A substance known as argentine has been introduced in Germany for making the so-called silver paper, which is used instead of tinfoil as a packing material. It is a finely-divided form of metallic tin, also known as tin dust, of such a texture as to become an extremely fine powder, which must be perfectly uniform in grain, of a bright metallic gray tint, and entirely free from crystalline particles. The author was for some time in charge of a manufactory of this article, and introduced some modifications in the process, which are described. The raw materials of the manufacture are tin, hydrochloric acid, and zinc. The first may be used in the form of block or grain tin, but generally waste materials, such as bearing metal turnings, which are obtained from railway repairing shops in large quantity, are preferred. These are very variable in composition, including both white and red metal, with the proportion of tin varying from 27·6 to 74·5 per cent. The solution is effected by boiling the alloys with hydrochloric acid in large copper vessels, taking care to keep the stanniferous material in large excess, under which condition the copper is not attacked, while the greater part of the tin dissolves, lead, copper, and antimony remaining wholly or partially undissolved. The solution is filtered through a layer of sand in a hard-wood tub with a double bottom, where the lead chloride contained in the hot liquor crystallizes out on cooling. The residues are passed on to another establishment, to be used in making copper and antimony preparations. The purified solution, consisting essentially of stannous chloride, with traces of antimony, lead, and iron, having an average density of 40° B., corresponding to about 23·5 per cent of tin, is diluted from one to two hundred times its volume of water, and transferred to large vats in which plates of zinc are suspended, when, if all conditions are right, the tin precipitates as a uniform gray mass, rendered spongy by the simultaneous evolution of hydrogen, falling, when dried and rubbed through a sieve, to a fine dust.

The precipitate is removed every day, fresh liquor is added, and the process is renewed until the zinc chloride solution remaining has reached a strength of 20° to 25° B., when it is removed and concentrated to 50°, corresponding to a strength of 52 per cent of chloride of zinc. This is readily sold, as it is extensively used for preserving railway sleepers. The finished product should be as nearly as possible pure tin. An average sample analyzed by the author contained: Hygroscopic water, 0·83 per cent; lead, 0·6 per cent; zinc, 0·83 per cent; the remainder being tin, with small traces of iron, chlorine, and antimony.

As the silver paper is used in wrapping up provisions, the tin dust used in its preparation must not, according to the sanitary laws of the German empire, contain more than 1 per cent of lead.

In the year 1890 the price realized varied from 77*l.* to 77*l.* 10*s.* per cwt.

Formerly silver paper was made by covering ordinary white paper with a priming of white lead and size, upon which either silver leaf or tinfoil was cemented. At present this has been almost entirely replaced by argentine, which is made to adhere to the paper by the use of so-called wax solutions, prepared by methods which are kept secret. According to the author, the methods are as follows:

In the first, 4 kilos. of wax and ¾ kilo. of potash are boiled with 50 kilos. of water, and the melting fluid so produced is stiffened to a thick paste by stirring the tin precipitate into it.

In the second, 75 liters of freshly made 4 per cent starch solution are mixed with 750 grms. of a wax solution prepared from 5 lb. of wax and 1½ lb. of potash dissolved in hot water, and 25 kilos. of argentine are added.

The paste so obtained is printed by rolls on to paper, which dries to a dull gray tone, but becomes bright when burnished by passing through hot calender rollers, when it exactly resembles tin foil.

Soap Bubble Solution.

According to a communication recently made to the Academy of Sciences the following solution affords very thin and permanent bubbles:

Yellow resin	10 grammes.
Carbonate of potash	10 "
Water	100 c. c.

Boil until completely dissolved, and before use dilute the solution with four times its volume of water. It is somewhat difficult to float soap bubbles upon carbon dioxide, because, if you managed, after a score of trials, to free your bubble from the pipe on which you blew it, the bubble usually bursts the moment it touches your heavy gas. Mr. Newth lets us into the secret in his recent book. You must remove every trace of hydrochloric acid, which is carried over with the gas, by washing, the presence of this acid being fatal to the life of a soap bubble.

Correspondence.

Color Blindness at the Miller School.

To the Editor of the Scientific American:

A report on the color blindness found in this school may be of interest, from the fact that, in accordance with the will of the founder, Samuel Miller, none of our pupils are of wealthy families, while all are from one county, Albemarle.

About two months ago I examined the pupils, some two hundred and sixty, of this school for color blindness, using Dr. Oliver's method, a modification of that of Holmgreen. There were five test skeins of worsted—red, rose, yellow, blue, and green—each with two skeins of darker shade and two of lighter tint. Besides these there were a large number of confusion skeins of different colors, shades, and tints.

The test was made in the usual way, by matching colors. Those who matched the colors correctly, red with red, green with green, etc., as a matter of course, were considered all right, while those who matched such colors as red and green together were considered color blind.

Of the two hundred and sixty persons, students with but few exceptions, examined, one hundred were girls and one hundred and sixty were boys. Not one instance of color blindness was found among the girls, while eight cases of very decided color blindness were found among the boys. Seven of these were cases of red blindness, being unable to distinguish between the so-called rose and green of the same shade. One boy seemed unable to distinguish between any two colors of the same shade, even matching rose, green, and yellow together.

It is stated by high authority that only one of a thousand women will be found color blind, while one of every twenty men has this defect. The above report, therefore, while interesting, should not be a surprise. W. J. HUMPHREYS, *Professor of Physics.*

The Miller Manual Labor School of Albemarle,
Crozet, Va., August 2, 1893.

A Simple Optical Photometer.

A simple optical photometer, serving also to measure the degree of visual acuity, has been devised by Dr. Simonoff. A book of twenty-four pages is arranged; the first being of a clear gray tint, the second of double the intensity, and so on to the last, the color of which is nearly black—being twenty-four times the intensity of the first. On every page are printed a few phrases in black letters of different sizes. The amount of illumination available in a badly-lit apartment may be estimated by turning over the pages of this little book, held at a distance of about a foot from the eyes, until one can no longer read the line of letters of a selected size. With good illumination, the characters on the twentieth or even the twenty-fourth page may be read; but with poorer light legibility ceases at the tenth, or twelfth, or fifteenth page. The appliance is meant for indoor use exclusively, and must, of course, be employed with intelligent reference to the power of the eyes of persons making the test. But it is said to give fairly reliable comparative indications of the degree of lighting in a building; and it is likely to be useful in ascertaining the sufficiency of the lighting of class-rooms and public buildings intended to be used for educational purposes.

The Modern Steamer.

In order to appreciate the great development of the steamship, which borders on the marvelous, the *Polytechnic* says, we have only to make a few figures as to the possibility of propelling a vessel with oars at the calculated speed of the Campania. If it were possible to place 300 oars on each side, making 600 oars altogether, each worked by three men, there would be 1,800 men at work at one time. As they could not work continuously for twenty-four hours, but only for a total of eight hours each man, divided into four-hour watches, it would be necessary to have a crew of 5,400 men alone to man the oars. If six men could develop one horse power, the total horse power developed by the 600 oars handled by 1,800 men would be but 300, as against 30,000 in the Campania, or the same power would require the employment of 180,000 oars and a crew of 558,000 men to manipulate them. The first steamer built by the Cunard Company was the Britannia, which was launched February 5, 1840, or fifty-three years ago. She was built of wood, by Robert Duncan, at Port Glasgow, her length being 207 feet; breadth, 34½ feet; depth, 22½ feet; tonnage, 1,156; passengers carried, 115; cargo, 224 tons. The engines, by Robert Napier, were side levers, with two cylinders, 72 inches diameter by 82 inches stroke of piston, driving paddle wheels 28½ feet diameter. Steam of 20 pounds pressure was provided by four flue boilers, with twelve furnaces, which consumed 38 tons of coal per diem. The speed of the vessel was 8½ knots, with the engine developing 710 indicated horse power; coal consumption, over 5 pounds per indicated horse power: time in making the voyage, 14 days.

© 1893 SCIENTIFIC AMERICAN, INC.

Man in South America.

There is no part of the world that offers a more curious subject of speculation as to its future than the continent of South America, as was well set forth in an address before the American Geographical Society, by its president, Mr. Gardiner G. Hubbard.

That the Amazon river system alone drains a basin of fertile land basking under a climate of perpetual summer, greater in area than the whole of Europe, is an astounding fact in itself. This vast territory is practically uninhabited. Its aboriginal population is disappearing, or has disappeared, and the whites, who in sparse number take their place, scarcely pretend to come with the expectation of remaining. There are tracts as large as the whole of France of which we know less than of any equal area on the globe. Tribes of men are living there who are yet absolutely in the stone age, and who, even by barter or distant rumor, never heard of the European race or the use of metals.

The question up to which Mr. Hubbard leads his reader is second in importance to none in anthropology —that of acclimation. Is it possible for the white race, when it shall be endowed with all the resources of art and science which it is soon to have in its grasp, successfully to fight against the terrible odds of a tropical climate? He quotes in his favor the words of the historian, Buckle, and the naturalist, Bates; he might have added others of weight; but it cannot be doubted that most of the medical observers who have devoted themselves to this vast inquiry lean to the opinion that never will the white race flourish under tropical skies.—*Science.*

Dr. Nansen's Polar Expedition.

After three years' preparation the Polar expedition under Dr. Fridtjof Nansen has finally sailed from Christiania, Norway, for the North in the good ship Fram (Advance), the first vessel that has been especially designed and constructed for Arctic research.

The party consists of twelve men, including Dr. Fridtjof Nansen, as leader of the expedition; Lieutenant Scott Hansen, R.N., as scientific member; and Henrik Blessing, M.D., as surgeon and botanist.

The expedition sails in the vessel Fram, which is a model of strength, but she is a trifle too small for the enormous amount of stores with which she has been loaded and which have brought her so down in the water that the ice sheathing has had to be heightened, while giving her hull the appearance of something between a Dutch koff and a Thames barge. The accommodation on board seems too cramped for twelve men. The main cabin or saloon measures but 6 ft. 3 in. in height, 13½ ft. in length, 16 ft. in width at the lower, and 11 ft. at the upper end, while the six sleeping cabins off it are diminutive. In the deck house are a small chart room and Dr. Nansen's study, both small in proportion, and on the whole it gives one the idea of being a neat little doll's house for twelve gigantic puppets. The stove in the saloon consists of an iron case containing numerous copper tubes, and is heated by paraffin lamps. Lighting will be electric or by means of lamps. The dynamo is worked either by steam, wind or hand power. A large windmill will be erected on deck, where there is also a winch which can be worked by four or more men, and, in order to give the hands sufficient exercise during the darkness, the latter will be daily resorted to in the winter months. The caboose, or kitchen, contains an ordinary cooking range, and also a very compact and handy copper stove heated by lamps, the gift of a London firm. The engines are triple expansion, and to obtain a speed of seven knots consume three and a half tons of coal a day, of which she carries a supply of about 350 tons, calculated for 200 days' continuous steaming at about four to five knots speed. The furnaces are constructed to burn petroleum, or even blubber, and under petroleum the vessel obtained on a trial trip the same speed as with coal.

The provisions are of various kinds, quantities being specially prepared on scientific principles, to give the men's stomachs the least possible expansion with the greatest possible quantity of nutriment. Clothing is of many sorts, from woolen jerseys and underclothing to fur outer garments and waterproof British linen. The sledges differ considerably from those taken by Astrup for the Peary expedition, being much lighter, from 9 ft. to 10 ft. in length, 1½ ft. in breadth, and about 6 in. in height. They are said, however, to be wonderfully tough, and capable of bearing heavy loads, and most are shod with German silver to protect the wood. Numerous Norwegian "ski" are also taken. The Fram carries seven large boats, including a naphtha cutter, of the ordinary sealing or whaling type, and will be used for the chase of walrus and seals and other sporting purposes, while two will be specially fitted for escape should any accident happen to the Fram herself.

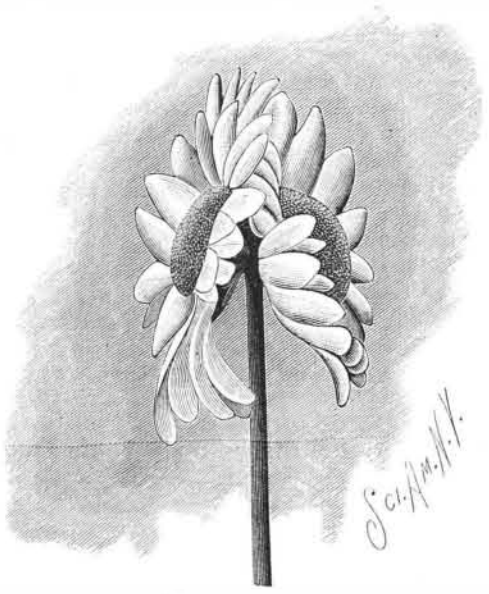
Last summer Dr. Nansen changed his plans, and announced his intention of proceeding, not via Behring Straits, but round the Norwegian and Russian coasts, to the spot north of the Liakov Islands which will be the starting point for the journey on the ice to the Pole. By adopting this latter route the sudden plunge into the glacial stream is avoided, but the chances of not reaching his destination at an early date are very considerably increased, as the ice in the Kara Sea may be impassable, and but very little is known of its conditions on the Siberian coast.—*London Daily Graphic.*

A TWIN DAISY.

Scores of adulatory verse have been written by poets of "the fields white-decked with nodding daisies." Gross dozens of earthen flower holders have been filled, by blooming maidens, with daisies for conspicuous ornamentation. The more practical husbandman, however, utters imprecations till the atmosphere takes on a cerulean hue as he speaks of those pests of his field, "them common daisies."

A very uncommon one, however, is the subject of ur illustration. Not for its economic or pictorial aspect do we show this strange departure from the regular growth, but on account, first, of its oddity, a genuine twin daisy; and second, because if one daisy is good, two on the same stalk must be better.

Daisies were not made alone for poets, maidens, or farmers. There is our old grandmother, bless her soul! when we were ourselves so enfeebled by weakness as to have copious night-sweats, such as fairly saturated the bedding with our oozing strength, she gathered some of these charming flowers and decorated the interior of the tin teapot with their beauty—practically steeped them into a tea and told us to drink freely of it, when cold. She knew better than farmer or poet that there were other virtues than verse and curse in this little creation of God. It stopped our night-sweats immediately, and



A TWIN DAISY.

in our builded-up strength we have thought possibly it were better to have two daisies grow where but one grew before.

Steel for a Cent a Pound.

In a recent interview with the reporter of one of the Pittsburg papers, Andrew Carnegie, when asked about the condition of the iron business, replied: "Well, I do not need to say anything about that; it speaks for itself. One pound of steel for one cent! The robber baron has ceased to rob and is now being robbed. The eighth wonder of the world is this: 2 pounds of iron ore, purchased on the shores of Lake Superior and transported to Pittsburg; 2 pounds of coal, mined in Connellsville and manufactured into 1¼ pounds of coke and brought to Pittsburg; one-half pound of limestone mined east of the Alleghenies and brought to Pittsburg; a little manganese ore mined in Virginia and brought to Pittsburg; and these 4½ pounds of material manufactured into one pound of solid steel and sold for one cent! That's all that need be said about the steel business. The capacity of the country to manufacture is beyond its wants. Some furnaces and mills must stop, others must restrict production, and, until that is done, we must expect the continuance of low prices. It is the same all over the world. England is even worse than we are, but she has endured the depression so long that she has closed many of her works. The longer all parties continue to run, the lower prices will become, and the more disastrous the stop will be to some of these when the end comes."

The Latest Form of Trolley.

According to the Baltimore *Sun*, the novel sight of a man taking the place of the trolley rod on an electric car was recently seen on the Lake Roland Elevated Railroad. The trolley on one of the large electric cars was caught in a wire, and the entire trolley apparatus was torn off, falling to the street. The accident happened at a time when the traffic was heavy, and it was necessary to prevent a block. A linesman was equal to the occasion. He procured a piece of insulated wire, and, after stripping each end of the insulating material, connected one end through the car roof and, standing on the top of the car, held the other end against the wire. A connection being thus made, the car was run over the elevated structure to the car shed without accident or delay to the other cars.

Spiders and their Foes.

The spider, rejoicing over the captives ensnared in his silken meshes, and binding them securely in his larder as stores against hungry days, lives in continual danger of a righteous retribution, which awaits him at the hands of many foes; but the ghastliest of all is the ichneumon fly, which does not kill its victim, but merely paralyzes it and renders it a totally passive agent incapable of offering the smallest resistance to the cruel power which enthralls it.

I believe that the English representative of this family makes its nest underground, so it generally escapes observation; but the ichneumon fly of Ceylon works in full light of the sun, where all who care to watch its domestic habits can do so.

It is a green insect, in form resembling a wasp, with a marvelously thin waist. It makes its nest of well-worked clay, and then goes out on a hunting expedition. Its victims are invariably spiders of various kinds, but all are subject to the same mode of treatment. A scientific sting injects some poison which effectually paralyzes the luckless spider, who is then carried off to the nest and there fastened with a dab of moist clay. Another and another victim is brought to this chamber of horrors. Then the prescient mother ichneumon fly proceeds to deposit her eggs, one in the body of each spider, which can just move its legs in a vague, aimless manner, but can offer no resistance.

This done, the fly returns to her work as a mason. She prepares more clay and builds up the entrance to this ghastly cell. Then she commences a new cell, which she furnishes in like manner, and closes; then she adds yet another cell, and so proceeds till her store of eggs are all provided for, and, her task in life being accomplished, she dies, leaving her evil brood to hatch at leisure.

In due time these horrid little maggots come to life and find themselves cradled in a larder of fresh meat. Each poor spider is still alive, and his juices afford nutriment for the ichneumon grub, till it is ready to pass into its chrysalis stage, thence to emerge as a winged fly, fully prepared to carry out the traditions of its ancestors with regard to spiders, and to fulfill the purpose for which they have been created, according to ichneumon belief.

In California the spiders live in dread of a certain yellow-winged dragon fly, which darts upon them, stabs them, and devours them. One wary spider, which is there called tarantula, or, more properly, the trap-door spider, constructs for itself a house of refuge, where it retreats in the hour of danger. It is a wonderfully ingenious architect, and displays amazing skill and patience in contriving and constructing its home, which in truth is a fortress, with a strong door to keep out all besiegers.

The nest is a little well of clay sunk in some earthy bank, just large enough to admit an average-sized human thumb. The interior is smoothly polished, but this so-called tarantula is not content with bare plastered walls. She is a diligent worker, ever weaving dainty fabrics; so she lines her home with a double curtain—a hanging of coarse spider cloth next the wall, and over that a rich white satin material, smooth and glossy.

At the upper end of the well-like nest there is a circular door, fastened with a sort of hinge. It opens outward, so that when the spider goes out, it falls and closes of its own accord, and no foe would ever notice the little disk in the earthen bank, which is the only trace of the tarantula's home. But to make assurance doubly sure, the wary spider provides means to secure it on the inside. At the side furthest from the hinge it leaves several small holes in the disk, and by clinging to these with its claws it keeps the door tightly closed from the inside, so that no enemy can enter.

The door is in itself a marvelous contrivance, and a monument of patient ingenuity. Though barely the eighth of an inch in thickness, it is composed of thirty triple layers, each consisting of a coating of clay, lined with two ply of spider cloth similar to the tapestry within the nest. These ninety layers are all fastened together, making a solid door, which is largest on the outside, and fits into a groove, so that it closes quite tight. I suppose sufficient air for breathing purposes comes in at the keyholes.

The yellow-winged dragon fly, against which the spider defends itself so securely, even endeavors to scratch open the closed door behind which its prey has taken refuge. But once within that portal, the fugitive is safe from winged foes. His chief danger then lies from the keen-eyed Indians, who know what a ready sale these curious silk-lined clay nets command among the pale-faced travelers from far countries, many of whom have already obtained very similar spider nests from the shores of the Riviera, and are anxious to compare the spider architecture of the Old World and the New.—*C. F. Gordon-Cumming in Leisure Hour.*

© 1893 SCIENTIFIC AMERICAN, INC.

Algonquin Park.

The great forests of Canada have for years been suffering as much from fires and from reckless cutting as have the wooded regions of our own country, and this fact the thoughtful people of the Dominion have, fortunately, begun to realize. The public desire to interpose some check to the pitiless attack upon the woods, and to save a portion of what remains in its primeval condition, took form a few years ago in a project for establishing in the province of Ontario a forest reservation and national park, and commissioners to make inquiry concerning the matter were appointed in the spring of 1892. This commission, of which Mr. Alexander Kirkwood was the chairman, made a report last March, and the bill prepared at their suggestion has since then been enacted as a law under the title of "An Act to Establish the Algonquin National Park of Ontario." Under this act a tract of land in the northern part of the province, some forty miles long and thirty-six miles wide, has been set apart "as a public park, forest reservation, fish and game preserve, health resort and pleasure ground for the benefit, advantage and enjoyment of the province of Ontario," and the lieutenant-governor in council is empowered to add to the park any adjoining townships or parts of townships in which no lands have been heretofore granted. Our experience in the case of the Adirondack Forest and elsewhere shows the difficulty in setting apart any considerable part of the public domain when it includes scattered areas which have become the property of private individuals. Fortunately, although some of the timber included in Ontario's new park had been disposed of, the crown continued to hold the title to the land itself, so that no vested interests stood in the way of securing complete possession. It is fortunate, too, that under the laws of Ontario the park could be placed directly under the control of the Department of Crown Lands, and that the governor in council was authorized to make all needed regulations for the maintenance and management of the park, so that it was not necessary in the beginning to formulate any elaborate code of administration. The commission, too, seems to have been singularly fortunate in that they were able to secure so large a tract and one which is shown by the report to be in so many ways suitable for the purpose it was to serve.

The site itself is an elevated area, containing but little soil fit for cultivation, with few high hills, but many successive ridges of Laurentian rock alternating with valleys and marshes. It lies on the summit which divides the waters flowing toward the Georgian Bay from those which flow into the Ottawa River, and rises to a height of 1,300 or 1,400 feet above the sea level. There is probably not elsewhere in the province a tract which, within the same small space, gives rise to so many important streams, and the commissioners do well, therefore, to note that one of the most important functions of the reservation will be that of maintaining and regulating the water supply of these streams. The park itself contains large volumes of water in lakes, rivers, brooks and ponds, the entire water surface covering about 166 square miles, while the area of the land is 1,300 square miles. Fortunately, the forest cover of this region is practically unimpaired, so that it will not be difficult to preserve in their original condition these elevated lakes and the streams which run under overarching woods.

The park is a place of singular beauty. The clearing of land for agricultural use, the cutting away of the timber for lumber, with the added ravages of fire, have almost effaced throughout the older settled parts of Ontario, as well as of the United States, the memory of the beautiful woodland scenery which once prevailed all over the land; and while the preservation of forests in their original state is advisable for economic reasons, it certainly is also worth while to preserve somewhere a remnant of country in its original condition, so that the native and untamed beauty of forest, lake and river may be enjoyed forever. Some kinds of trees, once common in Ontario, are becoming scarce; wild flowers and undershrubs, which diversified the primeval forests, are now almost forgotten where they once abounded, and the perpetuation, therefore, of a large district in its original sylvan conditions will afford a keen pleasure to the visitor as well as a field of study to the student, while for all it will preserve pleasing memories of the past.

Game, fur-bearing animals and some kinds of birds, once abundant throughout Ontario, are becoming scarce. Not many years ago the moose, the monarch of the Canadian woods, browsed in the proposed reservation, herds of red deer grazed in every meadow, the beaver built his dam on every stream, and the bear, mink, otter, and marten were common. The great game has been pursued with the same ferocity which has practically exterminated the buffalo on our own plains. In the spring of 1887 there were found in the district now set apart as a park for the province the carcasses of no less that sixty moose, which had been killed for their skins alone. Surely it is wise to fence in one spot in Ontario where these innocent tenants of forest and stream can be saved from the cruelty and greed which pursues them to the point of extermination, and where they can rear their young in safety.

Here, too, as the commission well points out, is a fair field for experiments in systematic forestry on a limited scale. Forest fires and the operations of lumbermen have diminished the quantity of pine still standing, but extensive areas within the park limits are still well stocked with this valuable wood, and hard wood trees grow in great abundance in groves or mixed with pine. Besides white and red pines, hemlock, tamarack, balsam and cedar, there is an abundance of black birch, with maple, beech, ironwood, ash and basswood. This variety of trees will furnish opportunities for experiments in every department of forest culture.

Nor is it unreasonable to suppose that so large a reservation will have a growing importance as a sanitarium. Its height above the sea level, its succession of hill and valley, lake and river, its groves of balsam and cedar and pine, which are supposed to have some specific value in curing certain diseases, combine to offer great advantages to invalids who are likely to improve under the conditions of an outdoor life in the pure air and at a high altitude.

Altogether, the establishment of Algonquin Park, a name which perpetuates the memory of the powerful Indian nation who held sway over this territory centuries ago, seems to mark an important advance in the development of Ontario. A hundred years hence it will be cherished as one of the most precious possessions of the province. It is to be hoped that these reservations will be multiplied both in this country and in Canada. There is small danger that the wants of coming generations in this respect will be too lavishly provided for.—*Garden and Forest.*

Peach Yellows.

The Agricultural Department has just issued a bulletin on the subject of peach yellows, prepared by Special Agent Erwin F. Smith. It embodies the results of four years' experiments with fertilizers to determine their value as preventives and cures of the disease. The experiments were made in the Middle States, and Dr. Smith says he is satisfied that peach yellows cannot be prevented or cured by fertilization of the soil. He therefore recommends that further experiments be abandoned.

The report made by Special Agent Dodge on the leaf fibers of the United States has just been published by the Department of Agriculture. Mr. Dodge says that the United States annually imports $8,000,000 worth of leaf fibers, a large proportion of which should and could be grown in this country. The pineapple industry in the United States is increasing each year, and it is believed that if the fiber contained in the leaves of the plant can be successfully extracted after the fruit has been gathered, it will add largely to the profitableness of the pineapple industry.

Fishing by Electricity.

An apparatus for fishing by electricity consists of a large iron frame interlaced with netting, which can be opened and closed at the will of the operator. An electric light incased in a lantern is lowered into the net, the electricity being furnished by a motor in the bow of the boat. As the boat moves along the network is thrown open, and the bright light of the lamp, which is seen at a great distance in the clear water, arouses the curiosity of the fish, which readily swim into the trap.

RECENTLY PATENTED INVENTIONS.

Engineering.

ROTARY ENGINE.—Wentworth Rice, Rapid City, South Dakota. This engine has a main cylinder and two auxiliary cylinders, the latter about half the size of and one on each side of the main cylinder, the three pistons turning in the cylinders being secured on one main shaft. A cut-off valve is arranged close to the piston to shorten the inlet port for cutting off the steam at any time during the revolution of the piston, to use the steam expansively in the cylinder. The engine is perfectly balanced and arranged to utilize the steam very economically and to the fullest advantage.

Mechanical.

TOOL HOLDER.—John C. Hunter, San Francisco, Cal. This invention relates to tool holders for lathes, planing, shaping, slotting, and other machines. It provides a head made in sections, between which the tool is clamped, one of the sections being adapted to be seated in the stock. To securely hold the tool in proper position the sections are provided with recesses or grooves corresponding to the cross section of the tool, the latter being clamped in place by the screwing up of nuts. The device is of very simple and strong construction.

Agricultural.

CATTLE STALL.—Jakob Aeberly, St. Paul, Minn. This is an improvement in stalls for milk cattle, providing therefor a feed crib protected by a pendent gate, to the lower end of which is hinged a cover, a shaft being attached to the gate and a flexible device on the cover, whereby the latter may be adjusted toward or from the feed crib. The arrangement is such that when the gates and covers are closed the animals will naturally step rearwardly, and maylie down upon clean platforms, thus enhancing their comfort and conducing to their regular feeding.

THRASHING MACHINE ATTACHMENT.—Alfred Gilmore, Stillwater, Minn. This is a device to be substituted for the usual cylinder and concave in machines for thrashing flax. Adjacent to the feed rollers is a group of thrashing rollers comprising lower supporting rollers upon which rests an upper pressing roller, composed of independent disks, guides bearing against the ends of the pressing roller, while a flexible armed beater is located in advance of the thrashing group of rollers. As the flax straw fed to the machine varies in thickness the disks of the pressing roll rise and fall, while pressing equally upon the straw throughout the length of the thrashing rolls, preventing the escape of unbroken heads, without breaking or injuring the straw.

Miscellaneous.

METAL ROOFING.—Benoit B. Detombay, Chenee, Belgium. Metal roofing sheets are, according to this invention, formed with parallel hollow ribs, with interlocking tongues on the edges of the sheets, the construction being such that the fastening rivets or nails will be covered, and the joints rendered absolutely wind and water tight. The sheets may be rapidly applied to a vertical wall or a roof having any degree of pitch, making a very ornamental and extremely strong roofing.

CASH REGISTER.—Charles J. Passick, Seward, Neb. This is a register adapted to be secured beneath a counter, and to display to a purchaser when operated the amount of a purchase, which is also registered. The cash drawer can only be opened when one of the registering buttons is pressed. The device is operated positively, and is but little likely to get out of order. A gong is rung every time the drawer is opened.

VENDING MACHINE.—Owensby H. Woodfill, Nevada, Mo. This is a machine especially adapted to deliver packages containing stamps, car tickets, etc., or small packages or books. A sight opening in the casing shows the coin deposited to work the mechanism of the machine, any smaller coin falling into the coin compartment without causing a delivery of the goods. The machine is designed to be of very simple, compact, and durable construction, and the invention covers various novel features of construction and combinations of parts.

ROCK DRILL.—Harvey P. Jones, Denver, Col. A drill adapted to be operated by hand or power, which may be held at any desired angle, and has an automatic feed, has been provided by this inventor. The drill-holding frame is supported by a strap from the body of the workman, who will ordinarily turn an operating crank by hand, pulling back a hammer against the tension of springs, the hammer upon its release striking upon the shank of the drill. The rebound of the drill is taken up by a special mechanism, and the drill is turned at each blow, the mechanism being such that by a moderate turning of the crank a rapid succession of powerful blows will be struck and the drill will be held up to its work all the time.

WAREHOUSE GANG PLANK.—Lonard Kuckartz, Portland, Oregon. A framed structure having at one end a hinged, wedge-shaped apron and flap plate is hereby provided, to form an improved removable gangway from a warehouse to a car or the reverse. The device is of simple construction, and adapted for easy stowage below the floor of the warehouse, while convenient for extension therefrom and adjustment for service, being also adjustable in its parts to suit cars having floors of varying height relatively to the warehouse floor.

PAPER BOX.—Joseph T. Craw, Jersey City, N. J. This invention provides a blank in one piece, which may be quickly and conveniently folded to assume the shape of Noah's ark, thus affording a novel receptacle for fancy crackers, candies, etc. In a box thus made the articles may be packed without danger of the box coming open unless it is to reach the contents.

SOFA, TABLE AND BED.—Dennis W. Palmer, Gloucester, Mass. This is a combination piece of household furniture which may be quickly changed to fit it for one or another use. It consists of a frame having heads, each formed with a hinged section, a table hinged to the heads being adapted to form a back for the frame, and also to be supported on the heads, while there is also a bottom head in sections hinged together, one of the sections being hinged to the frame.

BLIND STOP.—William W. Hoskins, Houston, Texas. A short metal rod attached to the lower end of the slat strip of the window blind is pivoted at its other end to a pivoted toothed segment swinging in a semicircular case fastened to the bottom rail of the shutter, the notches of the toothed segment being engaged by the tooth of a spring-pressed detent. Upon pressing upon the detent, the slats of the blind may be moved up or down and adjusted in any desired position, for the regulation of the light and air, the detent, when released, locking the segment and slat strip in position.

DOOR HANGER.—Theodore C. Prouty, St. Joseph, Mich. This invention relates to an improvement in trackless door hangers, two hangers being used with each door, and the construction admitting of such connection that when the door is closed or entirely open it rests upon the floor, while in its movement from a closed to an open position, or *vice versa*, the door is raised above the floor or carpet. The device is designed to be simple and durable, and not liable to get out of order when fitted to a door.

WINDOW GARDEN SPRAY.—Benjamin F. Sill, Long Island City, N. Y. In a short section of hose is a compressible bulb formed integral with a spraying nozzle, by means of which the plants may be easily and thoroughly sprinkled in every direction, without danger of breaking or injuring them in passing the nozzle between the branches. The outer end of the hose section, to be placed in a pail or other vessel containing water, is provided with a filter to prevent the passage of impurities or obstructions.

KITCHEN AND IRONING TABLE.—Mrs. Johanna Voos, 76 East 86th Street, New York City. This table has a hinged leaf, supported when extended by legs adapted to fold at its side, the top surface of the table and leaf being padded, and the padded surfaces folding together when used simply as a kitchen table. A sliding board in front forms an ironing board for shirt bosoms, etc., and a sliding board at one end forms a bracket on which the irons may be placed. A box is supported under the table by means of chains, the box being adapted to receive and store the sad irons, etc., and being arranged to be drawn up and locked in place on the under side of the table top. The table normally occupies only the space of the usual kitchen table, but may be readily opened out to constitute a large and very convenient ironing table.

CIDER MILL.—Clemment W. and Enoch G. Gest, Brazier, Ohio. The hopper of this mill has a grinding wheel with knives on its periphery, and the hopper discharges into a chute at the bottom of which is a chamber with a horizontal slowly working plunger which is hollow and has a head covered with canvas to form a strainer. The press box is cone-shaped and its interior is lined with canvas, and by using the canvas lining in the press box and the strainer over the plunger the pulp may be ground very fine, none of it escaping through the fabric forming the strainer and lining.

WRITING TABLET AND COPY HOLDER.—George H. Munson and George B. Haines, New York City. This is a combination device more especially designed for the use of stenographers, to hold the book or paper in proper position for taking or copying notes. The tablet is provided with a holder pivoted to swing either to the front or back, while a support is pivoted on the sides of the tablet and keepers at the pivot ends of the support, the keepers having angular offsets to limit the outward movement of the support. The device is of very simple and inexpensive construction, but is designed to be a great convenience to stenographers and typewriters.

MEASURING PROPORTIONAL PARTS FOR MIXTURES.—Alexander K. Sudduth, Memphis, Tenn. This invention provides a conveniently manipulated gauge for determining the amount of any two or more articles to be combined to make a mixture, the articles being placed in separate compartments, and the gauge manipulated to simultaneously drop the predetermined quantities. The gauge is especially adapted for dental use, for regulating the proportionate amount of mercury and amalgam, or other articles constituting a filling or for use in making a plate.

NOTE.—Copies of any of the above patents will be furnished by Munn & Co., for 25 cents each. Please send name of the patentee, title of invention, and date of this paper.

© 1893 SCIENTIFIC AMERICAN, INC.

NEW BOOKS AND PUBLICATIONS.

QUALITATIVE ANALYSIS TABLES, AND THE REACTIONS OF CERTAIN ORGANIC SUBSTANCES. By E. A. Letts. Belfast: Bayne & Boyd. 1892. All rights reserved. Pp. 91.

This is one of those books with elaborate tables designed to lie upon the working table of the chemist or on his desk, to be referred to constantly. Its excellent and clear printing, its selection of subjects and its full index make it of particular value for this purpose.

THE PERFECT CALENDAR FOR EVERY YEAR OF THE CHRISTIAN ERA. By Henry Fitch. 1891. New York: Funk & Wagnalls Co. 8vo. Pp. 37. Price 50 cents.

Perpetual calendars are by no means new, but the present work appears to have solved the difficulty of furnishing a perfect perpetual calendar which is simple and intended for everyday use. With this little book all the difficulties of old style and new style are brushed away. A brief history of the calendar is annexed.

ANNUAL REPORT OF THE MINISTER OF PUBLIC WORKS FOR THE FISCAL YEAR 1890-91. Parts I and II. Ottawa. 1893. 8vo. Pp. 231, 419. Price 50 cents.

Canadian annual reports, Part II, contains the water levels of the river St. Lawrence between Quebec and Montreal. Illustrations to accompany Part II come in a separate volume, price 90 cents.

CYCLOPEDIC REVIEW OF CURRENT HISTORY. First quarter 1893. A. S. Johnson, A.M., Ph.D., editor. Buffalo: Garretson Cox & Co. 8vo. Pp. 214. Illustrated. Price 40 cents.

This is not a new publication, as it is numbered vol. 3, No. 1, but it has changed hands. The Review is intended to give a clear and dispassionate view of the events of contemporary history. Some of the headings are as follows: The Behring Sea dispute, the Hawaiian question, the reciprocity policy, U. S. politics, the merchant marine, cholera, necrology, disasters, silver question, etc.

☞ Any of the above books may be purchased through this office. Send for new book catalogue just published. MUNN & Co., 361 Broadway, New York.

SCIENTIFIC AMERICAN

BUILDING EDITION.

AUGUST, 1893.—(No. 94.)

TABLE OF CONTENTS.

1. Elegant plate in colors, showing the villa erected for J. Armoy Knox, at Primrose Park, Mount Vernon, N. Y., at a cost of $14,928 complete. Floor plans and two perspective elevations. An excellent design.
2. Plate in colors showing the colonial residence of L. Allyn Wight, at Montclair, N. J., erected at a cost of $15,400 complete. Perspective view and floor plans. Messrs. McKim, Mead & White, architects, New York. An attractive design.
3. A cottage erected at Portland, Me. Perspective view and floor plans. A model design. Cost $3,400 complete. Mr. J. C. Stevens, architect, Portland, Me.
4. A Queen Anne cottage, erected at Wayne, Pa., at a cost of $6,000 complete. Floor plans, perspective view, etc. Messrs. F. L. & W. L. Price, architects, Philadelphia, Pa. An excellent design.
5. Engraving and floor plans of a dwelling recently erected for A. B. Root, Esq., at Springfield, Mass., at a cost of $2,500 complete.
6. Engraving and ground plan of Grace Episcopal Church, at Plainfield, N. J., erected at a cost of $40,000, complete. Mr. R. W. Gibson, New York City, architect.
7. A dwelling recently completed at Brookline Hills, Mass., at a cost of $5,120, complete. Perspective elevation and floor plans.
8. A cottage at Elm Station, Pa., erected at a cost of $3,900, complete. Floor plans and perspective.
9. Wood and stone dwelling at Narberth, Pa. A unique design. Perspective elevation and floor plans. Estimated cost $5,000, complete.
10. Design for a village library.
11. The Fifth Avenue Theater, New York. View of the family circle and of the handsome drop curtain. Mr. Francis H. Kimball, architect, New York.
12. A suggestion in corner decoration. Bay window decorations.
13. Miscellaneous contents: Wiring of buildings for electric lights.—Montauk club house, Brooklyn, N. Y.—A novel system of domestic water supply, illustrated.—Wood mantels and ornamental fireplaces, illustrated.—Fencing made of sheet metal, illustrated.—The Hartman sliding blind.—view of factories.— An improved dimension saw, illustrated.—Plumbers' and steamfitters' supplies.—The Capitol hot water heater, illustrated.

The Scientific American Architects and Builders Edition is issued monthly. $2.50 a year. Single copies, 25 cents. Forty large quarto pages, equal to about two hundred ordinary book pages; forming, practically, a large and splendid MAGAZINE OF ARCHITECTURE, richly adorned with elegant plates in colors and with fine engravings, illustrating the most interesting examples of Modern Architectural Construction and allied subjects.

The Fullness, Richness, Cheapness, and Convenience of this work have won for it the LARGEST CIRCULATION of any Architectural Publication in the world. Sold by all newsdealers. MUNN & CO., PUBLISHERS, 361 Broadway, New York.

Business and Personal.

The charge for Insertion under this head is One Dollar a line for each insertion; about eight words to a line. Advertisements must be received at publication office as early as Thursday morning to appear in the following week's issue

Order pattern letters & figures from the largest variety. H. W. Knight & Son, Seneca Falls, N.Y., drawer 1115.

"U. S." metal polish. Indianapolis. Samples free.

Woodpulp machinery. Trevor Mfg. Co., Lockport, N.Y.

Steam Disinfectors.
Geo. T. McLauthlin & Co., 120 Fulton St., Boston, Mass.

Patent Open-Side Planing and Shaping Machines. Pedrick & Ayer, Philadelphia, Pa.

Wm. Jessop & Sons have a handsome display of steel in Mining building at the World's Fair.

The Improved Hydraulic Jacks, Punches, and Tube Expanders. R. Dudgeon, 24 Columbia St., New York.

Will purchase patent of meritorious small article. Give particulars. Manufacturer, box 2238, New York.

Stow flexible shaft. Invented and manufactured by Stow Mfg. Co., Binghamton, N. Y. See adv., page 127.

Screw machines, milling machines, and drill presses. The Garvin Mach. Co., Laight and Canal Sts., New York.

Centrifugal Pumps for paper and pulp mills. Irrigating and sand pumping plants. Irvin Van Wie, Syracuse, N. Y.

Wanted—Capital to develop a patent. For sale, two patents, in whole or part. "Develop Patent," 11 Washington Street, Newark, N. J.

Split Pulleys at Low prices, and of same strength and appearance as Whole Pulleys. Yocom & Son's Shafting Works, Drinker St., Philadelphia, Pa.

Perforated Metals of *all* kinds and for *all* purposes, general or *special*. Address, stating requirements, The Harrington & King Perforating Co., Chicago.

The best book for electricians and beginners in electricity is "Exper mental Science," by Geo. M. Hopkins. By mail, $4; Munn & Co., publishers, 361 Broadway, N. Y.

Competent persons who desire agencies for a new popular book, of ready sale, with handsome profit, may apply to Munn & Co., Scientific American office, 361 Broadway, New York.

☞ Send for new and complete catalogue of Scientific and other Books for sale by Munn & Co., 361 Broadway, New York. Free on application.

Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters, or no attention will be paid thereto. This is for our information and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.

Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.

Scientific American Supplements referred to may be had at the office. Price 10 cents each.

Books referred to promptly supplied on receipt of price.

Minerals sent for examination should be distinctly marked or labeled.

(5286) L. R. B. asks: Could unused arc lightcarbons be used with advantage as positive poles of batteries? If so, how are they best arranged in cell and what solutions should be used? What would be the E. M. F. and resistance of such battery? A. The electric light carbons can be used as you suggest. If they are copper coated, the copper must be removed by means of mtric acid. The solution used in zinc carbon batteries is made **by dissolving bichromate** of soda in water, making a **saturated solution, and** slowly adding to this solution one-fifth of its bulk of commercial sulphuric acid. The zinc should be amalgamated.

(5287) J. B. T. asks: Will you kindly inform me through your paper where I can get some information about oxidizing silver or if you know of a good formula to be used for that purpose? A. Dip the clean silver article in a solution of sulphide of potassium (liver of sulphur), 2 drm. to a pint of water. Heat this solution to a temperature of 175° F. Immerse for a few seconds only, when the article becomes blue black. For a velvet black, dip the article, previous to oxidizing, in a solution of mercurous nitrate and water and rinse. Then dip in the sulphide solution as above. For a brown shade, oxidize in the potassium sulphide as above, then dip in a liquid composed of 10 parts blue vitriol and 5 parts sal ammoniac to 100 parts vinegar. After oxidation brush with a scratch brush very lightly, to brighten and variegate the surface.

(5288) B. L. Association writes: An electric lighting company contracts to light the streets of our city with arc lights of 2,000 standard candle power each. What is the standard candle of comparison, and how may we know, with reasonable accuracy, what power lights we are furnished with? Is any book published which gives full information in regard to the strength of lamps and lights as furnished by electric lighting companies, and method of measuring same? A. The candle power is nominal; 2,000 candle power really equals the light of about 800 sperm candles, each burning 120 grains per hour. Your contract should specify current and potential. We cannot recommend a book covering the precise ground which you specify.

(5289) J. C. C. writes: I have come across a number of open circuit batteries with the binding posts so corroded by the action of the solution as to make them useless. After the batteries have been charged, would it not be advantageous to put on top a tablespoonful of heavy oil, to stop the salt from keeping; or would this be injurious to the life of battery? A. Oil can be used as you describe. It has the objection of being dirty. It is a good plan to give a coating of paraffin to the upper half inch of the jar.

(5290) F. R. C. asks: 1. Will wooden cells, well lined with black pitch, about ⅛ in. thick, be durable for storage cells? A. The use of wooden cells is not advisable. With a proper mixture they can be made serviceable. It is doubtful if plain black pitch would answer. 2. What shall I use to seal the above cells? Also rubber and glass cells? A. The cells should not be sealed, as, in charging, gas is often evolved. They may be partly closed by any form of stopper; best of rubber.

(5291) H. J. S. asks for a formula of a composition or name of a substance which when placed in water will assume larger proportions, and when removed from same will not resume its original size, but remain compact and hard? A. Compressed soft wood, such as holly, answers your requirements.

(5292) P. S. asks: Will the motor described on page 497 in "Experimental Science" run the dynamo described on page 487? Will there be any gain in strength of current? A. With sufficient current the motor referred to will drive the dynamo, but there will be no gain in strength; on the contrary, there will be a loss of from 25 to 50 per cent.

(5293) J. J. S. writes: I run a small desk fan attached to a No. 1 Porter motor on the regular incandescent light wires. To prevent fuse melting it is necessary to put a lamp in the circuit, but the fan will only run with a 32 c. p. lamp, 1 or 2 16 c. p. lamps having no effect whatever. Can you give the reason for this, and also if I can run the fan without any lamp in the circuit? A. Without introducing some resistance in the circuit along with your motor, the motor takes an amount of current which is sufficient to heat and melt the fuse. Probably your motor is running very uneconomically. If it were wound with fine wire, so as to have a suitable resistance, it would take the requisite amount of current and run with much greater economy. It is important, in connecting up a motor in an electric circuit, to have the motor adapted to the current and electromotive force.

(5294) P. J. L. asks whether illuminating or fuel gas can be made from the action of sulphuric acid upon zinc, and its gas forced through a carburetor for a commercial value, and, if so, at about what cost? And further, does this make a better gas for illuminating purposes than air carbureted which contains no acid gas? A. The gas you describe cannot be made commercially, as it is very expensive. It makes a better gas than carbureted air.

(5295) E. J. M. asks at what time the ancient classification of four elements was made and by whom? A. Earth, air, fire, and water were elements enumerated by Empedocles. Ether was added to these as a fifth element. The division undoubtedly preceded Empedocles' time.

(5296) A. B. C. asks: 1. I inclose a sample of some mineral which is found near this town; it is found from four to six feet below the surface of the ground among gravel, and it is also found embedded in slate stone. I tried to melt some of it, but when it reached a dull red heat it took fire and burned with a blue flame and smelled very strong of sulphur. The flame does not last long, but it stays hot a long time. I also inclose a sample of stone resembling slate, which when broken smells like petroleum, and when heated gives off a gas which burns. Please tell me what they are. A. The mineral sent is iron pyrites in shale, of no value. 2. How much weight will a straight electro-magnet lift, the core of which is made of ¼ inch iron, 3 inches long, and wound with 4 layers of No. 18 double-wound wire, if a current of one volt E. M. F. is sent through it, the distance of the weight from the pole of the magnet being ⅛ of an inch? A. Your magnet might lift 2 ounces. A magnet of this form is not well adapted to lifting or sustaining weights; better use a magnet of horseshoe form. 3. Should the air be kept out of a sal-ammoniac battery? A. Sealing the battery prevents evaporation. If your battery has a porous cell, the sealing should be perforated to allow the escape of air on **the entrance of the solution** into the porous cell. 4. In **making an electro-magnet** what rule is there for finding the amount of wire required for a given size of iron? A. The common rule is to make the depth of the winding equal to the diameter of the core. 5. What is meant by ampere turns? A. An ampere turn is the equivalent of one ampere carried once around a magnet core; thus the passage once around the core of one ampere is an ampere turn, or 10 turns of a wire carrying one-tenth ampere is an ampere turn. 6. How many ohms are required to destroy the effects of one volt on a delicate galvanometer? A. It is doubtful if any amount of resistance would entirely destroy an E. M. F. of one volt. Much depends upon the sensitiveness of the galvanometer.

(5297) F. L. A. asks: 1. How to put the black finish on brass. A. The fine black finish on brass is made by dipping in a solution made of 5 drachms perchloride of iron dissolved in one pint of water. Also by rubbing the surface with chloride of platinum salt moistened. 2. What causes the alternate circles of light and dark under the electric light? A. The band shadows under the electric light are probably the effect of diffraction, possibly intensified by reflection from the inside of the globe. 3. Where can I buy Clerk Maxwell's work and what is the price? A. We mail J. Clerk Maxwell's "Theory of Heat" for $1.25; "Elementary Treatise on Electricity," $2.25; his larger work in two volumes on "Electricity and Magnetism," $8.

(5298) F. W. P. asks: 1. How can I reduce stick phosphorus to a powder, or to a form I can handle in making an alloy? A. Use red phosphorus. Stick phosphorus cannot be powdered and is very unsafe to work with. 2. Can mercury be deposited on brass so that it will not scratch off? If so, how? I have a bell metal gong I wish to make a reflector of. A. This is an impossibility as far as a practical reflector is concerned. Silver-plate it.

(5299) R. A. G. writes: Will you please tell me which is the best system of penmanship for a telegraph operator's use—whether back or forward hand, which can be written the faster, also where can I get the system you recommend? A. The best system of penmanship for telegraphic, *i. e.*, receiving, is that which is simplest and quickest to execute. This appears to be the moderately rounded hand with forward stroke; it is natural for the action of the muscles and admits of great speed.

INDEX OF INVENTIONS

For which Letters Patent of the United States were Granted

August 15, 1893,

AND EACH BEARING THAT DATE.

[See note at end of list about copies of these patents.]

Acid, apparatus for the distillation of hydrochloric, E. Solvay 503,557
Acid, making carbonic, E. Luhmann 503,286
Agrafe, Schimmel & Nelson 503,167
Alarm. See Fire alarm.
Armatures, winding coils for dynamo-electric, J. B. Blood 503,449
Armatures, winding coils for dynamo-electric, E. Thomson 503, 5
Auger bit, A. L. Adams 503,224, 503,225
Autographic register, L. C. Farmer 503,582
Ax wedge and guard, G. P. Morrill 503,351
Axles, forging, F. Horn 503,481
Banjo bridge, C. F. Albert, Jr 503 396
Battery. See Galvanic battery.
Battery jar, A. M. Gee 503,132
Basement ventilator, P. H. Jackson 503,434
Basin, bathtub, etc., wash, A. O'Brien 503,249
Bearing, thrust, A. K. Watt 503,260
Bed bottom, C. M. Hunt 503,540
Bed bottom, Keephart & Hackett 503,323
Bedstead, A. D. Cooke 503,196
Bicycle, H. S. Williams 503,513
Bicycle gun carrier, P. Gendron 503,315
Bicycle pedal, A. L. Garford 503,306
Bicycle seat, supplementary, M. S. Shipley 503,170
Billiard or pool table, H. A. Berenter 503,261
Block. See Knife block. Meat block.
Board. See Game board.
Boiler. See Locomotive boiler. Wash boiler, Water tube safety boiler.
Boiler furnace, locomotive, J. Milton 503,155
Boiler furnace, steam, O. D. Orvis 503,314
Boiler stay or brace, J. M. Wilson 503,514
Boiler tube cleaner, R. Thompson 503,359
Boiler tube cleaner, steam, R. Thompson 503,559
Bolt forcer, D. T. & H. W. Young 503,188
Bolt rolling machine, W. Vollmer 503,393
Book stapling machine, J. T. O. Ortlof 503,271
Boot or shoe, G. L. Williams 503,303
Bottle stopper, H. Spriegel 503,333
Box. See Cigarette box.
Box fastener, W. H. Lowry 503,285
Brace, G. M. Pilcher 503,437
Braid rack, A. H. Martin 503,488
Brake. See Car brake. Machine brake.
Brake beam, T. H. Simpson 503,441
Brake lever, F. Pfiegbar 503,385
Brake shoe, Hofstaetter, Jr., & Stiligebauer 503,138
Brewing beer, G. H. Schneider 503,168
Brick and tile machines, automatic cutter for, D. Brown 503,534
Bridge counterbalance, R. P. Lamont 503,377
Bridge, draw, Turner & Warner 503,273
Bridge driving mechanism, R. P. Lamont 503,378
Broiler, meat, F. M. Blamyer 503,307
Brooder, poultry, E. P. Snyder 503,172
Buckle, snap, G. F. C. Schroter 503,499
Buildings, batten and padding for closings joints in, G. Knower 503,426
Buoyant fabric, Heinze & Reinmuth 503,373
Burner. See Hydrocarbon burner. Vaporizing burner.
Burner for sawdust or refuse fuel, R. H. Nogar 503,328
Cabinet, W. S. Stanley 503,444
Cameras, ground glass attachment for, M. Bauer 503,518
Can. See Tin can.
Can unsealing attachment, S. W. Simmons 503,500
Candy, etc., machine for rolling, cutting, and shaping, Dobyns & Bro wn 503,230
Car brake, J. A. Brill 503,121
Car brake beam, railway, F. J. Cole 503,263
Car brake operating device, H. H. Bierbaum 503,118
Car coupling, D. W. Hansam 503,347
Car coupling, C. T. Harrison 503,346
Car coupling, J. A. Hinson 503,208
Car coupling, T. H. Nunn 503,490
Car coupling, D. Sprecher 503,175
Car coupling, A. Stein 503,503
Car coupling, link, G. Beekman 503,116
Car gear, street, M. G. Hubbard 503,142
Car journal box, J. J. Busenbenz 503,405
Car loading apparatus, D. C. Boyce 503,364
Car vestibule, E. L. Perry 503,180
Cars, bell cord hanger for railway, G. F. S. Clamer 503, 06
Cars, rocket holder for railway, J. Gallagher, Jr 503,234
Carriage top joint, J. T. Groves 503,135
Carrier. See Egg or fruit carrier.
Cartridge shell, T. G. Bennett 503,117
Carving fork guard, E. E. Wood, Jr 503,308
Caster, T. Polster 503,438
Chair foot rest, rocking, W. McQuillen 503,246
Chlorine and purifying lead, producing, F. M. & C. H. M. Lyte 503,429
Chuck, lathe, J. R. Howgate 503,374
Chute, coal, J. F. Schmadeke 503,439
Cigar bunching machine, E. Pisko 503,293
Cigar tip cutter, I. C. C. Rinehart 503,496
Cigarette box, T. E. West 503,512
Cigarette machine, continuous, J. H. Venners 503,507
Clamp, W. H. Dana 503,125
Cleaner. See Boiler tube cleaner.
Cleat, D. B. Bronson 503,193
Clip. See Hedge clip.
Clock striking mechanism, L. E. Courtin 503,310
Cloth stretching machines, chain clip for, A. A. Whitley 503,301
Clothes pin, G. W. McCoole (r) 11,358
Clutch, electric motor, Johnston & Browne 503,420
Coal piling apparatus, J. M. Dodge 503, 09
Coating with silver, composition of matter for, T. Z. H. St. Cyr 503,358
Cock for tanks for water closets, etc., ball, J. R. Allan 503,339
Cock, gauge, R. P. Ross 503,396
Coffee pot, W. P. Carlin 503,342
Coffee pot, E. J. Colby 503,563
Collar fastener, O. Watson 503,510
Collar stuffing machine, H. Hildenbrand 503,479
Compass, mariner's, E. S. Ritchie 503,164
Condenser, electrical, A. Wurts 503,186
Conductor supporter and insulator, D. T. Bennett 503,519
Connector, H. L. Webb 503,181
Converter, C. Vattier 503,179
Conveyer, H. Mock 503,326
Conveying apparatus, T. S. Miller 503,381
Cooking vessel, C. J. Parker 503,353
Corn and cob crusher and grinder, F. S. Rich 503,357
Cotton opener beater, R. Schaellibaum 503,256
Cotton openers and lappers, damper for, R. Schaellibaum 503,255
Coupling. See Car coupling. Hose coupling. Hose or pipe coupling.
Cover for barrels, etc., inside, Friedrichs & Fliege 503,414
Crank power for machinery, A. Wayne 503,394
Cross tie and railway support, metallic, J. M. Price 503,253
Crusher. See Corn and cob crusher.
Cultivator, J. Killefer 503,1 5
Cultivator tooth, spring, G. Moore 503,288
Cup and saucer, O. Walter 503,508
Cutter. See Cigar tip cutter. Egg cutter. Oil cloth cutter.
Cycle saddle, Guthrie & Hall 503,236
Cycle stand, E. Wood 503,185
Cyclometer, G. E. Kuhn 503,485
Dental disk and carrier, R. G. Stanbrough 503,258
Dental fillings, preparing, A. W. Johnston 503,419
Dials, apparatus for enameling, D. R. Buchanan 503,525
Direct-acting engine, W. A. Drewett 503,231
Dish drainer, J. Chase 503,278
Doll producing blank, I. A. Gutsell 503,316
Door hanger, sliding, W. Grabler 503,335
Door securer, F. J. Hales 503,536
Doors, device for simultaneously moving double, B. J. H. De Vry 503,361
Double turning shovel and colter, J. H. Cole 503,123
Draught spring, N. H. Davis 503,408
Drawing or stamping press, E. Jordan 503,422
Drier. See Hay drier.
Drill press, A. J. F. Mill 503,153
Drying roll driving gear, W. C. Mackinney 503,380
Dye, orange, F. Bender 503,305
Dye, substantive brown, R. Lauch 503,148
Eaves trough and support, M. M. Blacker 503,119
Egg cutter, C. Michel 503,431
Egg or fruit carrier, knockdown, T. S. Fitch 503,313
Electric circuit switch, McNeill & Tinder 503,157
Electric dry cell, R. Gabarro 503,445
Electric engine, W. Lawrence 503,487
Electric motor, alternating current, F. A. Wessel 503,183
Electric motor regulator, J. C. Davidson 503,453
Electric switch, E. P. Warner 503,180
Electric wire cleat, J. Pawolowski 503,394
Electrical connections, binding post for, A. Kohl 503,427

© 1893 SCIENTIFIC AMERICAN, INC.

Electrical energy, method of and apparatus for the transmission of, R. M. Hunter 503,321
Electrical reciprocating motor, H. S. McKay 503,213
Elevator. See Hay elevator.
Elevator doors, means for ope ating, L. Freas 503,345
Elevator safety attachment, C. B. Labatt 503,496
Elevator, shaft, G. Vassar, Jr 503,322
Embroidering machine, Buss & Saurer 503,079
Embroidering machine, R. Cornely 503,229
Embroidering machine, fabric holding frame, H. Hochrentener 503,320
End gate rods, manufacturing, G. B. Freeman 503,367
Engine. See Direct-acting engine. Electric engine. Rotary engine.
Engine, H. C. Miller 503,154
Engines, starting appliance for compound, Small & Noyes 503,390
Engines steering gear for traction, G. W. Kramer 503,146, 503,147
Equalizer, three-horse, J. C. Rice 503,163
Evaporating pan, F. M. Roberson 503,498
Extracts, process of and apparatus for making, Heftler & Benard 503,237
Fabric. See Buoyant fabric.
Farm gate, A. M. Murray 503,289
Faucet, W. F. Harris 503,477
Feedwater, device for purifying, Hoppes & Gwyn 503,209
Fe water heater, steam boiler, T. C. Best 503,521
Fence, wire, P. Sommer *et al* 503,219
Fencing machine, wire and p cket, H. J. Gebhardt 503,207
Fender, J. P. Rowan 503,331
Fender attachment, J. T. T. Kisinger, Jr 503,242
Fifth wheel, G. B. St. John 503,177
Fire alarm and individual electric call, J. Young 503,187
Fire alarm box, J. G. Kraetz 503,376
Fire escape, H. J. Clark 503,365
Fire escape, J. R. Jones 503,322
Fish trap, J. R. Crawford 503,197
Flask. See Foundry flask.
Flue stopper, C. H. Sobolle 503,388
Forge tray, R. S. Burnett 503,194
Forging machine, steam, W. A. Pearson 503,354
Foundry flask, P. B. McGregor 503,290
Fountain. See Water fountain.
Fuel, method of and apparatus for cons mption of, J. Y. Smith 503,501
Furnace. See Boiler furnace. Portable furnace.
Furnace, J. Davies 503,407
Furnace grate, B. Loomis 503,211
Gaff hook, G. A. Stanton 503,176
Gauge. See Saw gauge. Vacuum gauge. Watchmaker's gauge.
Galvanic battery, C. H. Brown 503,567
Game apparatus, A. Myers 503,382
Game apparatus, parlor, O. F. Brinkman 503,403
Game board, F. W. Hawkes 503,318
Game or exercising apparatus, W. P. Lyle 503,379
Garbage receptacle, C. J. L. MacLeod 503,212
Gas generator and burner, combined oil, M. Beck 503,399
Gas governor, Martyr & Eldridge 503,350
Gas purifying apparatus, J. Goets 503,133
Gas regulator, L. Gardner 503,131
Gas washing and scrubbing device, Wood & Tuffs 503,395
Gases, apparatus for treating pulverulent materials with, E. Solvay 503,556
Gases, treating pulverulent material with, E. Solvay 503,558
Gate. See Farm gate.
Gate, D. Baptist 503,448
Generator. See Gas generator.
Glass bottles, apparatus for the manufacture of, B. A. Spaull 503,220
Glove cabinet, A. Bever 503,306
Grate, A. Shearer 503,169
Grinding mower knives, machine for, R. Dutton 503,127
Hammer, power, W. Orcutt 503,492
Hanger. See Door hanger.
Harrow, W. J. Lawrence 503,545
Harrow, Neal & Suhr 503,434
Harrow, H. H. Sater 503,166
Harrow, disk, J. H. Thomas 503,178
Harvester, self-binding, P. Hanson 503,283
Harvesters, lifting device for self-binding, F. Burgroff 503,526
Hay drier and stacker, Guhr & Richter 503,368
Hay elevator, S. A. McAnulty 503,352
Heater. See Feedwater heater.
Heater, C. A. Howard 503,141
Hedge clip, R. Raby 503,161
Heel trimming machine, Fowler & Warren 503,475
Hexaoxyanthraquinone and making it, R. E. Schmidt 503,295
Hides, preparing, F. Grognet 503,235
Hinge, spring, Labudde & Hansen 503,249
Holdback, vehicle, C. A. Packard 503,158
Hook. See Gaff hook. Snap hook.
Hoop. See Toy hoop.
Hop picking machine, B. A. Beardsley 503,190
Horseshoe fastening, I. W. Allyn 503,397
Hose coupling, J. T. Hayden 503,370
Hose or pipe coupling, W. C. Gebhardt 503,282
Hydrocarbon burner, E. G. Mummery 503,548
Inking pad cushion, J. R. Keatinge 503,287
Insulator, L. McCarthy 503,549
Iron, manufacture of glazed, J. W. Kidwell 503,423
Jack. See Lumber loading jack. Window jack.
Jaiser's roll, J. C Rocheleau 503,218
Joint. See Carriage top joint. Rail joint.
Joists, bridging for flooring, F. H. Moore 503,245
Journal bearing, anti-friction, M. B. Jones 503,143
Journal bearing, anti-friction, F. G. Susemihl 503,296
Knife block for shaping cones, revolving, J. Haindl 503,317
Knob attachment, M. M. Brophy 503,228
Knob attachment, C. M. Burgess 503,450
Knob attachment, C. F. Doebler ..... 503,199 to 503,202, 503,204
Knob attachment, Doebler & Bryant 503,198, 503,203
Ladder, E. Blasberg 503,120
Ladder, fire, F. A. Biehn 503,362
Ladder, step, C. Rivers 503,165
Lamp, G. P. Kato, Jr 503,266
Lamp, electric arc, L. E. Howard 503,538, 503,539
Lamp socket, incandescent, C. T. Lee 503,349
Leather edge trimmer, J. Hook 503,348
Letter press, portable, C. R. Eberle 503,280
Lever, differential, A. Campbell 503,561
Loading machine, earth, J. Oppold 503,250
Lock case, F. J. Biggs 503,400
Locomotive boiler, W. B. Mack 503,287
Loom, A. D. Emery 503,467
Loom, Emery & Donnelly 503,472
Loom, irregular, A. de Laski 503,544
Loom double tension device, A. D. Emery 503,466
Loom let-off mechanism, A. D. Emery 503,462, 503,468
Loom picker, A. D. Emery 503,459, 503,464
Loom picker cam, A. D. Emery 503,473
Loom picking mechanism, A. D. Emery 503,470
Loom shedding mechanism, A. D. Emery 503,460, 503,469
Loom shedding mechanism, E. Ingrabam 503,375
Loom shuttle box operating mechanism, Knowlton & Meyer 503,542, 503,543
Loom stopping mechanism, A. D. Emery 503,461
Loom take up mechanism, A. D. Emery 503,468
Loom weft stop mechanism, A. D. Emery 503,466
Looms, fluff catcher for vertical, A. D. Emery 503,463
Looms, fluffing discharger for, A. D. Emery 503,471
Looms, lay driving mechanism for vertical, A. D. Emery 503,457
Looms, race rail for double shed vertical, A. D. Emery 503,465
Lubricator, C. E. Traves 503,503
Lumber loading jack, E. L. Stockin 503,335
Machine brake, B. T. Reilly 503,495
Mail crane, J. Teeter 503,221
Matrix making machine, Kletzker & Goesel 503,324
Measur ng apparatus, liquid, J. Lewis 503,149
Meat block, A. Weaver 503,511
Mechanical movement, S. G. Brosius 503,122
Metal banding or bale wiring tool, G. Schubert 503,257
Metal folding machine, plate, Niedringhaus & Wettengel 503,292
Mill. See Rolling mill.
Mouldboard, etc., auxiliary, C. E. Fox 503,413
Mop wringing apparatus, R. S. Kirkpatrick 503,541
Motor. See Electric motor. Electrical reciprocating motor.
Mower, lawn, W. D. Wansbrough 503,509
Mower rake attachment, J. Marshall 503,162
Needles, making, E. J. Hall 503,476
Nut and bolt lock, Clark & Haynie 503,195
Oil cloth cutter, J. W. Lewis 503,546
Orange cleaning machine, H. Learned 503,210
Ore separator, R. Dilworth 503,454
Organ, pipe, V. Anderson 503,226
Packing ring cutting machine, M. E. Briggs 503,341
Pan. Se evaporating pan. Vacuum pan.
Paper pulp beating engine, A. E. Reed 503,553
Penholder, J. R. Mamillan 503,151
Photographic washing apparatus, Kem & Frederick 503,144
Picture exhibitor, R. C. Elliott 503,129
Pigment or paint, manufacture of, J. W. Kidwell 503,424
Pipe-fitting, J. McIntyre 503,432, 503,433
Pipe or nut wrench, W. H. Conver 503,124
Pipe wrench, T. H. Oxnam *et al* 503,215
Plastic composition, non-corrodible, J. W. Kidwell 503,425
Plow, gang, A. J. & A. C. Andresen 503,515
Plow, sulky or riding, N. Swager (r) 11,361
Pocket, trousers, B. Bissinger 503,363
Poison feeding device, M. Kelly 503,289
Portable furnace, R. Reach 503,494
Power. See Crank power.
Press. See Drawing or stamping press. Drill press. Letter press.
Printer's chase, J. W. Osborne 503,251
Printing machine offset mechanism, W. H. R. Toye 503,391
Printing press register, H. D. Clayton 503 452
Pulp articles, machine for forming hollow, F. E. Keyes 503,264
Pulp grinding machine, wood, F. Andre 503,304
Pulverizing or disintegrating apparatus, S. Straker 503, 504
Pump, J. H. Branson 503,523
Pump, measuring, S. T. Dutton 503,529
Pump, oil can siphon, E. A. Franklin 503,232
Purse, coin, Woodbury & Greenbaum 503,417
Pyrometer, Uebline & Steinbart 503,337
Pyrotechnic device, H. J. Pain 503,383
Pyroxyline solution or compound, C. L. Borgmeyer 503,402
Pyroxyline solvent and its compounds, C. L. Borgmeyer 503,401
Rack. See Braid rack. Stovepipe rack.
Rail fastening, B. F. & M. F. Sparr 503,442
Rail joint, truss, J. M. Price 503,254
Railway, cable, J. W. Dotson 503,366
Railway rail joint connection, M. Hubbell 503,239
Railway rail tie and chair, P. Wheeler 503,184
Railway signal, J. Wayland 503,399
Railway signaling, I. A. Timmis 503,505
Railway switch, frogless, F. Schultz, Jr 503,440
Railway train, safety buffer, W. Neuman 503,270
Railways, electrical supply system for, J. W. Bates 503,566
Register. See Autographic register. Printing press register.
Regulator. See Electric motor regulator. Gas motor regulator.
Rein holder, V. L. Talbot 503,297
Rivets, machinery for making solid or tubular, H. S. Reynolds 503,729
Rolling mill, H. J. Gosling 503,134
Rolling sheet metal, apparatus for, J. Jenkins 503,241
Roofing, composition of matter for, G. A. Turnbull 503,336
Rotary engine, J. F. McElroy 503,550
Sad iron stand, M. S. Everett 503,410
Salts, apparatus for electrolysis of fused, W. E. Case 503,451
Sash fastener, Raymond & Nortb 503,294
Sash weight holder, J. Neil 503,291
Saw and planer, combined, J. Bowles 503,522
Saw gauge, C. F. Fowler 503,281
Scale, pattern maker's, J. T. Cowley 503,528
Seed grinder, cotton, J. T. Tullis 503,259
Seeding machine, J. B. Williams 503,274
Separator. See Ore separator.
Sewing machine attachment holder, G. Tucker 503,222
Sewing machine clutch, C. A. Dahl 503,311
Sewing machine shuttle, L. A. Miller 503,269
Shade and shade holder, Hellyer & Lawless 503,537
Shawl strap and traveling companion, combined, A. B. S. Phillips 503,355
Sheet feeding mechanism, Barnes & Smith 503,275
Sheet metal ware, enameled, G. W. Niedringhaus 503,247, 503,248
Shovel. See Double turning shovel.
Shutter fastener, J. S. Ebert 503,126
Sign, street car, L. Pingst 503,552
Sign, street or other, S Nicolai 503,489
Signal. See Railway signal. Switchboard signal.
Signaling, interlocking apparatus for railway, S. T. Dutton 503,530
Skate, roller, F. Frankenberg 503,233
Sleigh, J. C. F. Harris 503,478
Slicer and grater, C. F. Spery 503,272
Snap hook, H. W. Tufts 503,446
Soldering machine, F. H. Palmer 503,159
Spark arrester, G. H. Shoemaker 503,171
Spark arrester, N. W. Spencer 503,174
Spindle attachment, L. W. Huyck 503,240
Spraying device, J. J. Dugan 503,455
Spring. See Draft spring.
Stand. See Sad iron stand.
Staples, machine for the manufacture of, S. C. Davidson 503,264
Stave jointing machine, Plaukhary & Liggett 503,493
Steam muffler, D. Goff 503,534
Stone cutting machine, A. McDonald 503,156
Stopper. See Bottle stopper. Flue stopper.
Stovepipe rack, P. K. Peterson 503,216
Stoves or ranges, movable hood for, B. F. Carpenter 503,343
Strap or rope attachment, Robbins & Walrath 503,497
Sulky, W. J. Hamill 503,137
Sulky, D. W. Locke 503,428
Switch. See Electric switch. Electric circuit switch. Railway switch. Tramway switch. Trolley wire switch.
Switch actuator, W. F. & W. C. Stedman 503,384
Switchboard signal, electric, F. A. Pickernell 503,262
Switchboards, cabling system for multiple, C. E. Scribner 503,556
Switchboards, test system for multiple, W. D. Allison 503,115
Table slide, extension, R. G. Blaesius 503,192
Ta pcollapsible, W. W. Doolittle (r) 11,359
Te egraphic apparatus, A. Heil 503,872
Tie. See Cross tie. Railway rail tie.
Tile frame, Holliday & Brawley 503,369
Tile, metallic roofing, A. A. Spahmer, Jr 503,173
Time recording apparatus, workman's, M. Martin 503,430
Tin can, W. Haaker 503,265
Tire, pneumatic, G. F. Callaghan 503,560
Tire, pneumatic wheel, O. F. Persson 503,565
Tire setting apparatus, P. O'Brien 503,435
Tire valve, pneumatic, C. K. Welch 503,300
Toe weight, J. Buechner 503,404
Tongue support, D. C. Emerson 503,205
Tool, combination, G. W. Weiss 503,182
Toy, M. Schofield 503,387
Toy, J. Sheppman 503,389
Toy hoop, W. W. Blackshaw 503,191
Tramway switch, A. C. L. Engstfeld 503,474
Trap. See Fish trap.
Trimmer. See Leather edge trimmer.
Trolley wheel, J. F. Hall 503,128
Trolley wheel, electric, J. W. Clark 503,552
Trolley wire finder, H. C. Jones 503,421
Trolley wire switch, E. A. Sperry 503,443
Trough. See Eaves trough.
Truck, car, G. F. Fischer 503,412
Truss, A. Yost 503,223
Tug, shaft, T. W. Davies 503,564
Typewriter cabinet, W. Horrocks 503,418
Umbrella sup ort, A. M. Woods 503,358
Undergarment, J. A. Bennett 503,520
Underwaist, E. W. Philbrook 503,436
Urinal, A. O'Brien 503,491
Vacuum gage, W. A. Rockliff 503,390
Vacuum pan, J. H. Duncan 503,312
Valve, air brake, H. M. Lofton 503,244
Valve, engineer's graduating, W. O. Pelham 503,551
Valve for suction or blast pipes, relief, H. L. Day 503,126
Valve, hydrant, S. W. Lewis (r) 11,360
Vaporizing burner, hydrocarbon, A. J. English 503,531
Vehicle, controlling switch for electrically propelled, H. C. Davis 503,279
Vehicle seat spring back, H. E. Herrick 503,319
Vehicle, two-seated, C. C. Bradley 503,308
Vehicle wheel, J. G. Roseboom 503,554
Vending apparatus, coin controlled, H. L. Hook 503,139
Ventilator. See Basement ventilator.
Veterinary tooth cutter, G. W. Teufel 503,208
Vise, milling machine, F. Mossberg 503,327
Wagon seat, C. C. Field 503,411
Washboiler, W. P. Burke 503,262
Washer fastener for hose couplings, etc., J. W. Fletcher 503,344
Watchcase spring, J. H. Fleming 503,214
Watch guard, H. S. Hopper 503,480
Watch jewels, mechanism for setting, G. E. Hunter 503,483
Watchmaker's gage, J. D. Howell 503,238
Watch, stem winding and setting, C. H. Bagley 503,516, 503,517
Watch, stem winding and setting, C. P. Corliss 503,527
Watch, stem winding and setting, E. H. Flint 503,533
Watch, stem winding and setting, G. E Hunter 503,482
Watch, stem inding and setting, J. Stark 503,502
Watch, stop, A. C. Gunn 503,416
Water fountain, F. P. Hinds 503,417
Water purifying apparatus, J. J. Hoppes 503,140
Water tube safety boiler, H. W. Frackmann 503,130
Wheel. See Fifth wheel. Tro ley wheel. Vehicle wheel.
Wheelrims, method of and apparatus for forming compress, L. M. Todd 503,360
Whip, F. A. Sanford 503,332
Whip socket, F. M. Beidler 503,340
Whistle, steam, E. H. Lunken 503,547
Winding machine, A. A. Brigham 503,277
Winding mechanism, c p and bobbin, Lever & Grundy 503,325
Window, F. C. Armbruster 503,189
Window jack, M. Prendergast 503,217
Wire, apparatus for hardening and tampering steel, D. C. Bateman 503,396
Wire barbing machine, J. S. Reid 503,162
Wire netting machine, J. Rady 503,366
Wire rope drum reel, A. D. Benham 503,227
Wrench. See Pipe wrench. Pipe or nut wrench.
Writing receiver, A. Heil 503,371
Yoke, neck, F. J. Lytle 503,150

DESIGNS.

Badge, A. A. Low 22,696
Bicycle saddle post, W. Hillman 22,714
Box, G. W. McGill 22,701
Brush or hand mirror back, J. Walter 22,704
Button or like article, sleeve, F. H. Fraser 22,697
Cabinet, W. Mowry 22,707
Card, P. G. Mohr 22,695
Carpet, E. G. Sauer 22,694
Dish, soap, J. C. Bugh 22,705
Gas burner, T. H. Schmitz 22,711
Humidifier casing, O. Hoffmann 22,706
Knife, C. F. Smith 22,700
Lamps, stalactite for electric, J. Dalzell 22,712
Saddle seat, Jourdan & Hunt 22,713
Spoon, J. T. Curran 22,698
Spoon bowl, U. Racine 22,699
Stove, C. H. Boeck 22,709
Stove, oil, C. W. Wipfler 22,710
Table, F. C. Koenig 22,708
Textile fabric, C. H. Schopbach 22,693
Timpiece hand, W. C. Ball 22,702, 22,703
Velocipede frame, W. Hillman 22,715

TRADE MARKS.

Apparel, wearing, J. Maddocks 23,502
Bed springs, woven wire, B. Pitch 23,515
Bitters, stomach, Firm of Th. Lappe 23,489
Boots, shoes, and lasts, J. Maddocks 23,505
Candies, Hawley & Hoops 23,479
Canned corn, Illinois Canning Co 23,481
Canned fish, fruits, vegetables, soups, and milk, W. B. Timms 23,483
Canned fruits, vegetables, fish, meats, oysters, catsup, and soup, A. F. Remy Co 23,482
Clothing, boys' and children's, David Bros. & Rose 21,504
Cord, braided sash, Samson Cordage Works 23,509
Dentifrice, Wells & Co 23,485
Glass, rolled sheet, Mississippi Glass Co 23,510
Gum, chewing, W. S. Robison 23,479
Hams, breakfast bacon, and shoulders, Swift & Company 23,480
Hats, caps, and bonnets, J. Maddocks 23,503
Insect and vermin destroying preparations, Isaacsen & son 23,498
Knives, scissors, pocket implements and tools, and the like, Christy Knife Company 23,501
Lamps, arc and incandescent, W. D. & J. W. Packard 23,514
Lead, Chadwick Lead Works 23,511
Leather for boots and shoes and similar articles, combination, Lyman Smith's Sons Company, 23,506, 23,507
Liver purifier, Simmons Medicine Company 23,494
Medicated oils for external and internal use, C. Ketzer 23,487
Medicinal lotion for human and animal use, M. J. Elton 23,497
Medicine for the cure of blood, liver, and kidney diseases, A. V. Young 23,495
Mortar and coatings for walls, Perfection Chemical and Manufacturing Company 23,512
Ointment, As-Ker-Shaw Manufacturing Company 23488
Paper and envelopes, writing, Hurd & Co 23,500
Plaster, Portland cement, and analogous compositions, T. D. Whitaker 23,513
Remedies for diseases of the bowels, F. Fenn 23,496
Remedies for diseases of the head, throat, chest and lungs, Bucklen & Company 23,491
Remedy for coughs and colds and all inflamed conditions of the lungs and air passages, J. B. Hurff 23,492
Remedy for diabetes, J. R. Stroschein 23,493
Sirup, laxative or cathartic, Fig Honey Company, 23,490
Umbrellas, parasols, and canes, J. Maddocks 23,508
Washing fluid, Rand & Bell 23,485
Watchcases, Roseman & Levy 23,499
Yeast powder, Southern Coffee Co 23,484

A printed copy of the specification and drawing of any patent in the foregoing list, or any patent in print issued since 1863, will be furnished from this office for 25 cents. In ordering please state the name and number of the patent desired, and remit to Munn & Co., 361 Broadway, New York.

Canadian patents may now be obtained by the inventors for any of the inventions named in the foregoing list, provided they are simple, at acost of $40 each. If complicated the cost will be a little more. For full instructions address Munn & Co., 361 Broadway, New York. Other foreign patents may also be obtained.

Advertisements.

ORDINARY RATES.

Inside Page, each insertion - - 75 cents a line

Back Page, each insertion - - - - $1.00 a line

☞ *For some classes of Advertisements, Special and Higher rates are required.*

The above are charges per agate line—about eight words per line. This notice shows the width of the line, and is set in agate type. Engravings may head advertisements at the same rate per agate line, by measurement, as the letter press. Advertisements must be received at Publication Office as early as Thursday morning to appear in the following week's issue.

Patent Foot Power Machinery
Complete Outfits.
Wood or Metal workers without steam power can successfully compete with the large shops, by using our New LABOR SAVING Machinery, latest and most improved for practical Shop Use, also for Industrial Schools, Home Training, etc. Catalogue free.
Seneca Falls Mfg. Co.
695 Water Street, Seneca Falls N. Y.

WILSON IMPROVED IRON PLANERS.
STANDARD SIZES & KEPT IN STOCK. W. A. WILSON RIVER ST. ROCHESTER, N.Y.

IMPROVED ENGINE LATHES MODERN DESIGNS
Also Foot Lathes, Toolsand Supplies. Catalogue ree
Sebastian Lathe Co. 120-122 Culvert Street CINCINNATI, OHIO.

OIL WELL SUPPLY CO.
91 & 92 WATER STREET,
PITTSBURG, PA.
Manufacturers of everything needed for
ARTESIAN WELLS
for either Gas, Oil, Water, or Mineral Tests
Boilers, Engines, Pipe, Cordage, Drilling Tools, etc. *Illustrated catalogue, price lists, and discount sheets on request.*

PATTERN MAKER, H. VAN SANDS, 144 Centre St., N. Y.

WM. GRAVER TANK WORKS,
(INCORPORATED.)
Manufacturers of Iron and Steel
STORAGE TANKS.
OFFICE,
3d Floor, Rookery Bldg.
CHICAGO, ILL.

TO BUSINESS MEN

The value of the SCIENTIFIC AMERICAN as an advertising medium cannot be overestimated. Its circulation is many times greater than that of any similar journal now published. It goes into all the States and Territories, and is read in all the principal libraries and reading rooms of the world. A business man wants something more than to see his advertisement in a printed newspaper. He wants circulation. This he has when he advertises in the SCIENTIFIC AMERICAN. And do not let the advertising agent influence you to substitute some other paper for the SCIENTIFIC AMERICAN when selecting a list of publications in which you decide it is for your interest to advertise. This is frequently done for the reason that the agent gets a larger commission from the papers having a small circulation than is allowed on the SCIENTIFIC AMERICAN.

For rates see top of first column of this page or address MUNN & CO., Publishers,
361 Broadway, New York.

PRESS, $3
Larger size, for circulars, $8.
Small newspaper press, $44.
Money saver or money making business. Full printed instructions. Send stamp for catalogue of presses, type, paper, etc. KELSEY & CO., Mfrs., Meriden, Conn.

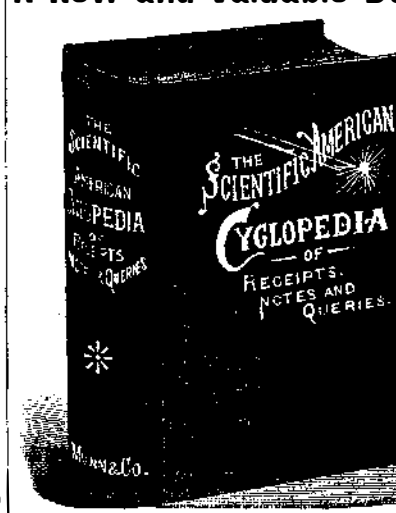
To Inventors.
E. Konigslow, manufacturer of Fine Machinery and Models, offers Special Facilities to Inventors. Guarantees to work out ideas in strictest secrecy, and *any improvement that he can suggest goes with the work.* Thousands of men have crude though really valuable ideas, which they lack mechanical training to develop. Novelties and patented articles manufactured by contract. 181 Seneca St., Cleveland, Ohio.

EDISON PHONOGRAPHS
FOR SALE.
ADDRESS,
North American Phonograph Co,
30 Park Place,
New York.
Masonic Temple Bldg.,
Chicago.

ALUMINUM: ITS USES AND APplications. A valuable and interesting article by G. L. Addenbrooke. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. 859. Price 10 cents. To be had at this office and from all newsdealers.

SYLPH CYCLES RUN EASY
All riders say, Our spring frame with pneumatic tires saves muscle and nerve and is luxury indeed. You want the best. Investigate. We also make a 30 pound rigid frame Sylph. Cats. free.
Rouse-Duryea Cycle Co. *Mfrs.* 16 Gst., Peoria, Ill.

A New and Valuable Book.



12,500 Receipts. 708 Pages. Price $5.
Bound in Sheep, **$6.** *Half-Morocco,* **$6.50.**

This splendid work contains a careful compilation of the most useful Receipts and Replies given in the Notes and Queries of correspondents as published in the Scientific American during the past fifty years; together with many valuable and important additions.

Over Twelve Thousand selected Receipts are here collected; nearly every branch of the useful arts being represented. It is by far the most comprehensive volume of the kind ever placed before the public.

The work may be regarded as the product of the studies and practical experience of the ablest chemists and workers in all parts of the world; the information given being of the highest value, arranged and condensed in concise form convenient for ready use.

Almost every inquiry that can be thought of, relating to formulæ used in the various manufacturing industries, will here be found answered.

Instructions for working many different processes in the arts are given.

Those who are engaged in any branch of industry probably will find in this book much that is of practical value in their respective callings.

Those who are in search of independent business or employment, relating to the home manufacture of sample articles, will find in it hundreds of most excellent suggestions.

☞ *Send for Descriptive Circular.*

MUNN & CO., Publishers,
SCIENTIFIC AMERICAN OFFICE,
361 Broadway, New York.

OHIO STATE UNIVERSITY, COLUMBUS, OHIO.
SCHOOL OF ENGINEERING.
Four-year courses in Civil, Mining, Mechanical and Electrical Engineering and in Industrial Art. Each department is well equipped with appliances for instruction. A catalogue will be sent on application.

HIGH SPEED ENGINES, SINGLE CYLINDER AND COMPOUND. WATERTOWN STEAM ENGINE CO. WATERTOWN N.Y.

© 1893 SCIENTIFIC AMERICAN, INC.

A New and Important Book on Coal Mining.

JUST READY.

THE MINE FOREMAN'S HANDBOOK

Of Practical and Theoretical Information on the Opening, Ventilating, and Working of Collieries. Questions and Answers on Practical and Theoretical Coal Mining, Designed to Assist Students and Others in Passing Examinations for Mine Foremanships. By ROBERT MAUCHLINE, Ex-inspector of Mines in Pennsylvania; Superintendent of Coal Mines. A new, revised, and enlarged edition, illustrated by 114 engravings, in one volume, 8vo, 337 pages, price $3.75.

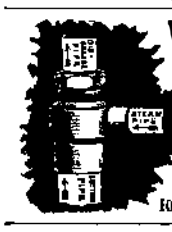
☞ *By mail, free of postage, at the publication price, to any address in the world.*

ABSTRACT OF CONTENTS: Chapter I, Mine Gases; II, Safety Lamps and Instruments; III, Ventilation; IV, Ventilation continued; V, Ventilation continued; VI, Maps—Pillars; VII, Mine Timber—Dams, etc.; VIII, Opening Collieries; IX, Railroad Tracks, Switches Frogs, Pulleys, etc., in and about a Mine; Index.

☞ *An Illustrated Circular 4 pages, quarto, giving the full Table of Contents of the above volume, sent free to any one who will furnish his address.*

☞ *Our New and Revised Catalogue of Practical and Scientific Books, 88 pages, 8vo, and our other Catalogues, the whole covering every branch of Science applied to the Arts, sent free and free of postage to any one in any part of the world who will furnish us with his address.*

HENRY CAREY BAIRD & CO.,
INDUSTRIAL PUBLISHERS, BOOKSELLERS & IMPORTERS
810 Walnut St., Philadelphia, Pa., U. S. A.



VANDUZEN STEAM JET PUMP

THE BEST IN THE WORLD.
Pumps Any Kind of Liquid.
Always in Order, never Clogs nor freezes. Every Pump Guaranteed.
10 SIZES.
200 to 12000 Gallons per Hour.
Cost $7 to $75 each. Address
THE VANDUZEN & TIFT CO.,
102 to 108 E. Second St., Cincinnati, O.

A REVOLUTION in the price of THE LEADING Illustrated Magazine of the World.

COSMOPOLITAN MAGAZINE
BY MAIL, $1.50 A YEAR.
4 MONTHS, 50 CENTS.
12½ CENTS PER MONTH

ADDRESS, 6TH AVE. & 11TH ST., NEW YORK.

CANNING MACHINERY

OIL BURNERS
for soldering and tempering
Air Pumps,
Can Wipers,
Labeling Machines,
Presses and Dies,
AND
Tin Working Mach'ery
BURT MFG. CO.
Rochester, N. Y.

TURNER ROTARY ENGINE

combines the uses of
1. **An Air Compressor.** Delivers air at 30 lbs. in a steady blast and to any extent by compounding.
2. **An Air Motor.** Solid piston moving in a rotary track.
3. **Vacuum Pump.** Keeping the gauge at 28 inches, a steady pull.
4. **Water Pump.** Is a suction and force pump.
5. **Water Motor.** Can be used simultaneously as a pump and motor.

Small size worked by hand; larger by steam, water, air or ordinary belt power. **No Valves or Springs.**

Made by **Turner Machine Co.**, New York, Manufacturers of the Turner Painting Machine which painted the interiors of the buildings at the **World's Columbian Exposition.**

Circular on application to **TURNER & CAFFIN, I. J. 34-35 Mach'y Hall, Jackson Park, Chicago.**
☞ *Agents wanted for above in every State.*

Useful Books!

Manufacturers, Agriculturists, Chemists, Engineers Mechanics Builders, men of leisure and professional men, of all classes, need good books in the line of their respective callings. Our post office department permits the transmission of books through the mails at very small cost. A comprehensive catalogue of useful books by different authors, on more than fifty different subjects, has recently been published for free circulation at the office of this paper. Subjects classified with names of authors. Persons desiring a copy have only to ask for it, and it will be mailed to them. Address,

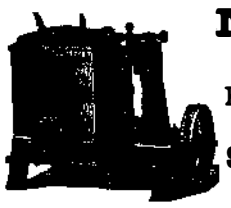
MUNN & CO., 361 Broadway, New York.

Subscribe for the *Scientific American*. No one should be without it. Copies should be preserved in files. Fully illustrated. Terms $3 per year. Address MUNN & CO., 361 B'dway, N. Y.

PATENTS

Caveats, Trade Marks, Copyrights, Designs, etc.

Handbook and information concerning Patents sent free of charge. Oldest bureau for securing Patents in America. Over 100,000 applications have been filed by MUNN & Co., 361 Broadway, N. Y.



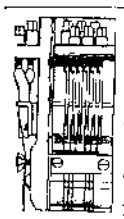
NO SKILLED ENGINEER.

THE SHIPMAN AUTOMATIC STEAM ENGINE.

KEROSENE OIL FUEL. 1, 2, 4, 6 and 8 HORSE POWER
No extra Insurance. Efficient, Economical, Durable.

SHIPMAN ENGINE COMPANY,
200 SUMMER STREET, BOSTON MASS.

CANE CONTRIVANCES.—TWENTY-two illustrations, with brief descriptions, of inventions relating to walking canes. The photographic cane, the brazier cane, the camera stand cane, the water colorist's cane, the mineralogist's cane, the stool cane, the drinking cup cane, the chair cane, toilet combination cane, the revolver cane, the gun cane, the picnic cane, the cigar lighter cane, the cigarette mould cane, the cigar holder cane, the candlestick cane, the inkstand cane, the snuff box cane, the spyglass cane, the lantern cane, the match safe cane, the physician's cane. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. 882. Price 10 cents. To be had at this office and from all newsdealers.



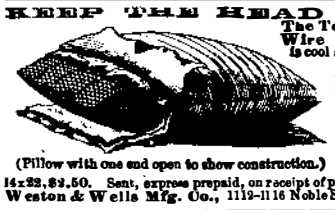
MASON & HAMLIN SCREW STRINGER

One of the greatest improvements in the history of the Piano Forte.
Keeps the Piano in Tune. Much More Durable. Quality of Tone Purer.
☞ *Fully Illustrated Catalogue sent on application.*
Mason & Hamlin Organ & Piano Co.
152 TREMONT ST., BOSTON, MASS.

Rubber Rolls and Wheels.

Power Wringing Machines, Drying and Ventilating Fans. All styles of Trucks made to order. Catalogues free. GEORGE P. CLARK,
Box L, Windsor Locks, Conn.

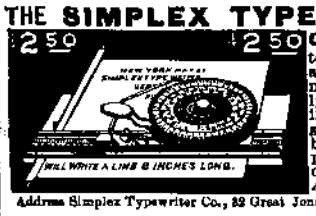
KEEP THE HEAD COOL



The Torsion Braided Wire Spring Pillow is cool and cleanly, inconducive to refreshing sleep. Health restoring to the sick. Practically indestructible. Price, upholstered in fine hair: Adults, 20x28, $3.50. Child's, 14x22, $2.50. Sent, express prepaid, on receipt of price. Address
(Pillow with one end open to show construction.)
Weston & Wells Mfg. Co., 1112-1116 Noble St., Phila., Pa.

SCIENTIFIC AMERICAN DYNAMO. Description of a plain shunt-wound dynamo of simple construction, capable of supplying a current of from 60 to 75 110-volt incandescent lamps, or of being used as a 5 h. p. motor. This machine was constructed especially for the benefit of the readers of the *Scientific American*, by Mr. W. S. Bishop, of New Haven, Conn. It is designed to meet the wants of mechanics and amateurs who desire to construct a simple dynamo for their own use, but who do not care to enter into the subject scientifically. With 24 illustrations. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. 865. Price 10 cents. To be had at this office and from all newsdealers.

THE SIMPLEX TYPEWRITER



GUARANTEED to do as good work as any high priced machine. Specially adapted for use in private correspondence. Sent by mail or express prepaid on receipt of $2.70. *See Sci. Am.*, Oct. 1, p. 211.
Address Simplex Typewriter Co., 32 Great Jones Street, New York.

ARKANSAS

Is the COMING State. Buy 40 acres there on Installments, improved farming land rents for from $3.00 to $7.00 an acre. Address W. B. BEACH, Bridgeport, Conn

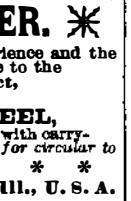
GATES ROCK & ORE BREAKER

Capacity up to 200 tons per hour.
Has produced more ballast, road metal, and broken more ore than all other Breaks combined.
Builders of High Grade Mining Machinery. Send for Catalogues.
GATES IRON WORKS,
50 C So. Clinton St., Chicago
136 C, Liberty Street, New York.
237 C, Franklin St., Boston, Mass

Perfect Newspaper File

The Koch Patent File, for preserving Newspapers, Magazines, and Pamphlets, has been recently improved and price reduced. Subscribers to the SCIENTIFIC AMERICAN and SCIENTIFIC AMERICAN SUPPLEMENT can be supplied for the low price of $1.50 by mail, or $1.25 at the office of this paper. Heavy board sides; inscription "SCIENTIFIC AMERICAN" in gilt. Necessary for every one who wishes to preserve the paper. Address
MUNN & CO., Publishers SCIENTIFIC AMERICAN

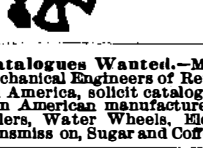
THE FOX SAFETY RAZOR.



(U. S. Patent 484,118, October 11, 1892.)
Is the finest and most practical in the world. Every man his own barber. Makes shaving a luxury. No danger of cutting; adjustable blade; silver plated frames. Price $2 by mail, free.
☞ *Catalogues sent free.*
E. LOTHAR SCHMITZ,
92 & 94 Reade St., New York.

✳ THE "MUNSON" TYPEWRITER. ✳

This machine is an "evolution," the outgrowth of years of experience and the best results of scientific work. Its principles appeal at once to the educated mechanic. It is Light, Small, Compact, Easily operated, with Universal Key Board.
INTERCHANGEABLE STEEL TYPE WHEEL,
durable and easily kept in order. 30 keys, 60 characters. Weight, with carrying case, 16 pounds. Special wheels for different languages. *Send for circular to*
* * THE MUNSON TYPEWRITER CO., * *
163 S. La Salle Street, Chicago, Ill., U. S. A.



HARRISON CONVEYOR!

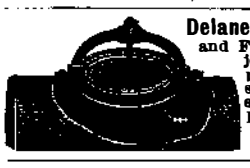
For Handling Grain, Coal, Sand, Clay, Tan Bark, Cinders, Ores, Seeds, &c.
Send for Circulars. | BORDEN, SELLECK & CO., {Sole Manu'f'rs,} Chicago, Ill.

Catalogues Wanted.—Messrs. Segrove & Lord, Mechanical Engineers of Retalhuleu, Guatemala, Central America, solicit catalogues, prices, and discounts from American manufacturers; especially of Engines, Boilers, Water Wheels, Electric Plants and Power Transmission, Sugar and Coffee Machinery.

$25 to $50 per week, to Agents, Ladies or Gentlemen, using or selling "Old Reliable Plater." Only practical way to replate rusty and worn knives, forks, spoons, etc; quickly done by dipping in melted metal. No experience, polishing or machinery. Thick plate at one operation; lasts 5 to 10 years; fine finish when taken from the plater. Every family has plating to do. Plater sells readily. Profits large. W. G. Harrison & Co., Columbus, O.

Model & Experimental Work.

Absolute secrecy. Advice and ideas not charged for. Send for particulars. GARDAM & SON, 98 John Street, NEW YORK.



Delaney's Metallic Gaskets and Flanges make everlasting joints. Delaney's Expansion Packings for steam, water and ammonia are best and cheapest. H. J. Delaney & Co., Third & Fowler Sts. Milwaukee, Wis.

THE MODERN MARINE BOILER.—By A. B. Willits, U.S.N. Description of the principal features of the boilers of the United States man-of-war New York, with a plea to inventive minds for the production of a type of boiler which shall do away with the necessity of the present enormously large and heavy shells, and present a lighter substitute that will perform the duties of both envelope and heating surface conjointly. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. 870. Price 10 cents. To be had at this office and from all newsdealers.

VOLNEY W. MASON & CO.
FRICTION PULLEYS, CLUTCHES, and ELEVATORS
PROVIDENCE, R. I.

Model & Experimental Work

Small Articles Manufactured in Quantities. Inventions perfected and developed. Working in Aluminum a specialty. S. P. Denison, Designer and Builder of Fine Machinery, 143 Centre St., New York.

Engineering School of the Western University of Pennsylvania

The leading Engineering School of Pennsylvania. Write for catalogue to
DANIEL CARHART, Dean,
Allegheny, Pa.

The name to remember when buying a **BICYCLE** is A. W. GUMP & CO., DAYTON, OHIO. **$30 to $50 saved** on many new and second-hand Bicycles. Lists free. Over 2000 in stock. Cash or time. Agents wanted.

FRUIT EVAPORATOR

"The Granger." For family use. *Cheapest in the market.* $3.50, $6 & $10. Circular
Eastern Mfg. Co., 259 South 6th St., Phila., Pa.

IMPROVED TROLLEY SYSTEM.—Description of an improved overhead system of electric traction recently adopted by the South Staffordshire Tramway Company. With 9 engravings. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. 886. Price 10 cents. To be had at this office and from all newsdealers. The same number contains a description (with 2 illustrations) of a new electric tramway at Paris, and also a description of Siemens & Halske's electric railway conduit, with 3 illustrations.

CELLULOID ZAPON Co.
MANUFACTURERS OF
CELLULOID LACQUERS
41 BARCLAY ST. NEW YORK
GUM LACQUERS - BRILLIANT AND DEAD BLACKS - SHELLACS &C

DRILL CHUCKS.

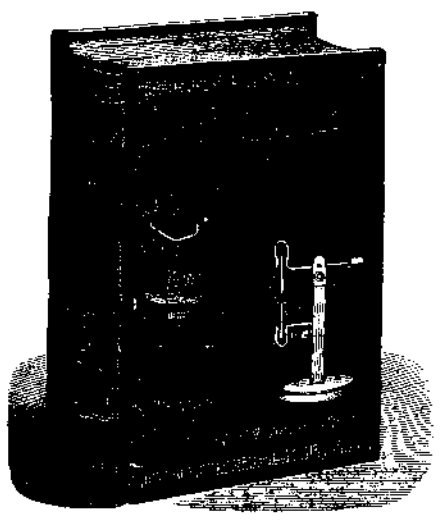
Write "THE PRATT CHUCK CO." Clayville, N. Y., U. S. A., for free illustrated catalogue of POSITIVE DRIVING DRILL CHUCKS, showing the only perfect system ever devised for holding and driving drills.

Foreign Agencies: Ph. Roux et Cie., 54 Boulevard du Temple, Paris, France. E. Sonnenthal, Jr., Nueu Promenade No. 5, Berlin, Germany. Selig, Sonnenthal & Co., 85 Queen Victoria Street, London, E. C., England.

NOW READY!

Fourteenth Edition of

Experimental Science



REVISED AND ENLARGED.
120 Pages and 110 Superb Cuts added.

The unprecedented sale of this work shows conclusively that it is the book of the age for teachers, students, experimenters, and all others who desire a general knowledge of Physics or Natural Philosophy.

In the new matter contained in the last edition will be found the Scientific Use of the Phonograph, the curious optical illusion known as the Anorthoscope, together with other new and interesting Optical Illusions, the Optical Projection of Opaque Objects, new experiments in Projection, Iridescent Glass, some points in Photography, including Hand Cameras, Cane Cameras, etc.; Systems of Electrical Distribution, Electrical Ore Finder, Electrical Rocker, Electric Chimes, How to Color Lantern Slides, Study of the Stars, and a great deal of other new matter which will prove of interest to scientific readers.

840 pages, 782 fine cuts, substantially and beautifully bound. Price in cloth, by mail, $4. Half morocco, $5.

☞ *Send for illustrated circular.*

MUNN & CO., Publishers,
Office of the SCIENTIFIC AMERICAN,
361 BROADWAY, NEW YORK.

Barnes' Hand, Foot & Steam Power

Iron & Woodworking Machinery

Examine our Exhibit at the WORLD'S FAIR.
Complete line of 30 machines. Machinery Hall, Section 14, Column J-36
☞ *Catalog e on application.*
W. F. & John Barnes Co.,
1999 Ruby St., ROCKFORD, ILLS.

WE SEND FREE

with this beautiful **Organ an Instruction Book** and a handsome, upholstered **Stool!** The organ has 11 stops, 5 octaves, and is made of Solid Walnut. Warranted by us for 15 years. We only charge $45 for this beautiful instrument. Send to-day for FREE illustrated catalogue. OXFORD MFG. CO Chicago.

ICE-HOUSE AND COLD ROOM.—BY R. G. Hatfield. With directions for construction. Four engravings. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. 59. Price 10 cents. To be had at this office and from all newsdealers.

STEEL TYPE FOR TYPEWRITERS

Stencils, Steel Stamps, Rubber and Metal Type Wheels, Dies, etc.
Model and Experimental Work.
Small Machinery, Novelties, etc., manufactured by special contract.
New York Stencil Wks. 100 Nassau St., N.Y

JUST PUBLISHED.

Star ⋆ Maps

By Richard A. Proctor, F.R.A.S.

* * *

A series of twelve elegantly printed Maps of the Heavens, one for every month in the year. Specially prepared for use in North America. With descriptions accompanying each map, giving the names of the principal stars and constellations, showing their relative positions at given hours and days of the month.

A most beautiful and convenient work, specially adapted for the use of those who desire to acquire a general knowledge of the starry realms.

To which is added a description of the method of preparing and using artificial luminous stars as an aid in fixing in the mind the names and places of the various stars and constellations, by Alfred E. Beach.

Altogether this is one of the most popular, useful, and valuable works of the kind ever published.

One quarto volume, elegantly bound in cloth. Price **$2.50**, postpaid.

MUNN & CO., Publishers,
361 Broadway, New York.

FREE A fine 14k gold plated ✱ watch to every reader of this paper. Cut this out and send it to us with your full name and address, and we will send you one of these elegant, richly jeweled, gold finished watches by express for examination, and if you think it is equal in appearance to any $25.00 gold watch, pay our sample price, $3.50, and it is yours. We send with the watch our guarantee that you can return it at anytime within one year if not satisfactory, and if you sell or cause the sale of six we will give you One Free. Write at once as we shall send out samples for 30 days only.
THE NATIONAL M'F'G & IMPORTING CO.,
334 Dearborn St., Chicago, Illinois.

WORKING MODELS & LIGHT MACHINERY. INVENTIONS DEVELOPED. Send for Model Circular. Jones Bros. E. Co., Cin'ti, O.

© 1893 SCIENTIFIC AMERICAN, INC.

Advertisements.

ORDINARY RATES.

Inside Page, each insertion, - 75 cents a line
Back Page, each insertion, - - $1.00 a line

☞ *For some classes of Advertisements, Special and Higher rates are required.*

The above are char es per agate line—about eight words per line. This notice shows the width of the line, and is set in agate type. Engravings may head advertisements at the same rate per agate line, by measurement, as the letter press. Advertisements must be received at Publication Office as early as Thursday morning to appear in the following week's issue.

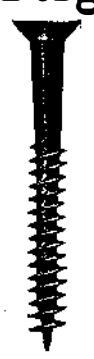
CASCADILLA SCHOOL

Ithaca, N. Y. Boys' Fitting School—the leading one for Cornell University. Preparing for Engineering Courses a specialty. Certificate widely accepted. General courses. Military drill. Tuition, $250; tuition and home, $600. Year opens Sept. 27. "I have never been acquainted with any which has more nearly realized my idea of what such a school ought to be."—R. H. Thurston, Director of Sibley College.
Address C. V. PARSELL, A.M., Principal.

New Highest Grade '92 Model Pneumatic Safeties
For $60, $60. $60.
Sold direct to riders only.
Former list $150.
A limited stock.
$60 Cash. *Eagle Bicycle Mfg Co., Torrington, Ct., Makers of Highest Grade Bicycles.*

COLD FORGED PRODUCT.

Forged Wood Screw



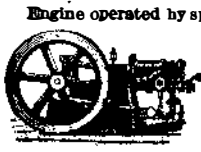
Patented May 10, July 19, 1887; Oct. 29, 1889; Aug. 19, Oct. 21, 1890; April 7 May 12, 1891; July 19, 1892.

Its Advantages are:
1. Stronger than a common screw.
2. Uniform and wide slot.
3. Requires the use of but one bit in hard wood.
4. Inserted easier.
5. Centralized point.
6. Superior holding power.
7. The screw being **Cold Forged**, instead of **Cut**, leaves on its entire surface a metallic skin.

☞ Send for samples to

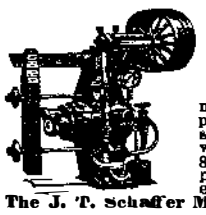
AMERICAN SCREW CO.
PROVIDENCE, R. I.

ELECTRO VAPOR ENGINE.
GAS OR GASOLINE FOR FUEL.
NO BOILER. NO FIRE. NO DANGER.
NO ENGINEER.
Engine operated by spark from small battery.



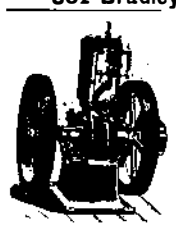
You turn the Switch, Engine does the rest.
Kane's Electro Vapor Stationary and Marine Engines, ½ h. p. upward, and Kane's Electro Vapor Pumping Engines, 250 to 10,000 gallons capacity.

—MANUFACTURED BY—
THOMAS KANE & CO.,
CHICAGO, ILL.
☞ *Send stamp for catalogue "V."*



HYDRAULIC WHEEL PRESSES
A SPECIALTY.
Cut represents a single pump machine for belt power. This press is made in various sizes to swing car wheels and drive wheels, 30, 36, 42, 54, 66, 72, 78, and 84 inches. Single or double pumps as required, and for generating from 30 to 300 tons.
The J. T. Schaffer Mfg. Co., Rochester, N. Y.

Parsons Horological Institute.
Learn the Watch Trade
Engraving and Jewelry Work.
PARSONS, IDE & CO. ☞ *Circular free.*
302 Bradley Ave., PEORIA, ILL.



SINTZ GAS ENGINE CO.
GRAND RAPIDS, MICH., U. S. A.
Manufacturers of the **Sintz Stationary and Marine Gas and Gasoline Engines.** Especially adapted for Boats and Electric Lighting. Runs with manufactured or natural gas—Boats and launches. Prices within the reach of all. ☞ *Send for Catalogue.* Mention this paper.

AGENTS WANTED WRITE FOR CATALOGUE AND AGENCY. **FOR FINE TOOLS IN EVERY SHOP.**
C. H. BESLY & CO.
CHICAGO, ILL. U.S.A.

PATENTS!

MESSRS. MUNN & CO., in connection with the publication of the SCIENTIFIC AMERICAN, continue to examine improvements, and to act as Solicitors of Patents for Inventors.

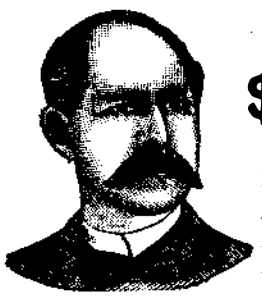
In this line of business they have had *forty-five years' experience*, and now have *unequaled facilities* for the preparation of Patent Drawings, Specifications, and the prosecution of Applications for Patents in the United States, Canada, and Foreign Countries. Messrs. Munn & Co. also attend to the preparation of Caveats, Copyrights for Books, Labels, Reissues, Assignments, and Reports on Infringements of Patents. All business intrusted to them is done with special care and promptness, on very reasonable terms.

A pamphlet sent free of charge, on application, containing full information about Patents and how to procure them; directions concerning Labels, Copyrights, Designs, Patents, Appeals, Reissues, Infringements, Assignments, Rejected Cases. Hints on the sale of Patents, etc.

We also send, *free of charge*, a Synopsis of Foreign Patent Laws, showing the cost and method of securing Patents in all the principal countries of the world.

MUNN & CO., Solicitors of Patents,
361 Broadway, New York.

BRANCH OFFICES.—Nos. 622 and 624 F Street, Pacific Building, near 7th Street, Washington, D. C.



W. L. DOUGLAS $3 SHOE For Gentlemen.

Best Calf Shoe in the World for the Price.

W. L. Douglas' name and price is stamped on the bottom before they leave the factory to protect you against high prices. Dealers who make the price on unstamped shoes to suit themselves, charge from $4 to $5 for shoes of the same quality as **W. L. Douglas $3.00 Shoe.** If you wish to get the best shoes in quality for your money it will pay you to examine W. L. Douglas Shoes when next in need. Sent by mail, **Postage Free,** when shoe dealers cannot supply you. Send for catalogue with full instructions how to order by mail.
W. L. DOUGLAS, Box 551, Brockton, Mass.

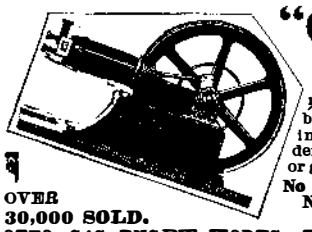
KODAKS

The Columbus Model Folding Kodaks combine the desirable features of a complete view camera with the compactness of a Kodak.

Recent Improvements include the iris diaphragm shutter with pneumatic release, double swing back and sliding front. Can be used with long focus or wide angle lenses.

Easily adapted to stereoscopic work. Made in three sizes: 4 x 5, 5 x 7 and 6½ x 8½.

EASTMAN KODAK CO.
Send for Catalogue. **Rochester, N. Y.**



"OTTO"
GAS AND GASOLINE ENGINES.
½ to 100 h. p. Can be used in cities or in country independent of gas works or gas machines.
No Boiler, No Danger, No Engineer.
OVER 30,000 SOLD.
OTTO GAS ENGINE WORKS, PHILADELPHIA.

THE COPYING PAD.—HOW TO MAKE and how to use; with an engraving. Practical directions how to prepare the gelatine pad, and also the aniline ink by which the copies are made, how to apply the written letter to the pad, how to take off copies of the letter. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. 438. Price 10 cents. For sale at this office and by all newsdealers in all parts of the country.

Scientific Book Catalogue

RECENTLY PUBLISHED.

Our new catalogue containing over 100 pages, including works on more than fifty different subjects. Will be mailed free to any address on application.
MUNN & CO., Publishers Scientific American,
361 Broadway, New York.

STEVENS PATENT SPRING SCREW THREAD CALIPERS
Leader, No. 71.
Price, by mail, postpaid.
3 inch, $0.75 | 4 inch, $0.90 | 6 inch, $1.00
These Tools, for fine workmanship and finish, have no equal in the world.
Ideal and Leader Spring Dividers and Calipers, Ideal Surface Gauges, Depth Gauges, and Fine Machinists' Tools.
☞ *Illustrated catalogue free to all.*
J. STEVENS ARMS & TOOL CO.
P. O. Box 280, Chicopee Falls, Mass.

"IMPROVEMENT THE ORDER OF THE AGE."

The Smith Premier Typewriter
Embodies the most Progressive Mechanical Principles.
All the Essential Features Greatly Perfected.
Perfect and Permanent Alignment.
Easiest Running, and Nearly Silent.
All type cleaned in Ten Seconds without Soiling the Hands.
The Smith Premier Typewriter Co., Syracuse, N. Y., U. S. A.
We have 20 branch offices in the principal cities throughout the United States.
Send for Catalogue.

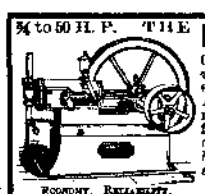
H. W. JOHNS' Liquid Paints

These Paints are composed of pure linseed oil and the highest grade of pigments. They are combined by processes exclusively our own and are unequaled by any in richness and permanency of color. One gallon will cover from 275 to 300 square feet, two coats without thinning and can be safely thinned with ½ gallon linseed oil to one gallon paint for first coat.

SAMPLE CARD OF 56 SHADES, INSTRUCTIONS FOR USE AND SUGGESTIONS FOR PAINTING ETC. FREE BY MAIL.

NEW YORK, JERSEY CITY, CHICAGO, PHILADELPHIA, BOSTON, ATLANTA

H. W. JOHNS M'f'G. CO.



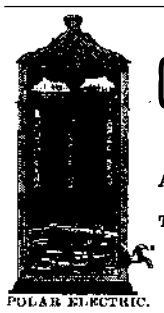
¾ to 50 H. P. THE Motor of 19th Century
Can be used *any place*, to do *any work*, and by *any one*. No Boiler! No Fire! No Steam! No Ashes! No Gauges! No Engineer! A perfectly safe Motor for all places and purposes. *Cost of operation about one cent an hour to each indicated horse power.* For circulars, etc., address
ECONOMY. RELIABILITY, SIMPLICITY, SAFETY.
CHARTER GAS ENGINE CO.
P. O. Box 148, Sterling, Ill.

LIFE SAVING DEVICES.— A COLlection of suggestions of devices for communicating between the shore and stranded vessels, offered to the London *Daily Graphic* by various correspondents. With 100 illustrations. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, Nos. **848, 849, 850, 851, 852, 854, 861, 862, 864, 869, 871, 874** and **884.** Price 10 cents each, or $1.50 for the series. To be had at this office and from all newsdealers.

THOMPSON IMPROVED INDICATOR

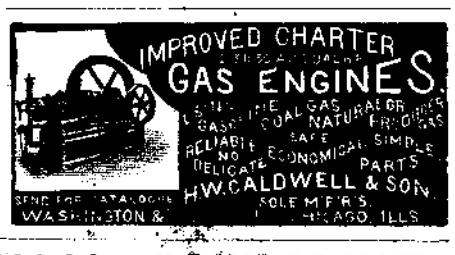
Manufactured solely by
American Steam Gauge Co.
5,000 IN USE.
Adopted by the U. S. Navy on all the government cruisers and gunboats to be built.
Also Manufacturers of
POP SAFETY VALVES,
STEAM PRESSURE GAUGES, ETC.
34 Chardon Street, Boston, Mass.

ASTRONOMY
Poole Bros. Celestial Planisphere and Celestial Handbook just published.
For descriptive circular address
POOLE BROS., CHICAGO, ILL.



The McCONNELL Germ-Proof Filters
REMOVE MICROBES
—AND—
All Kinds of Disease Germs.
Is a Filter and Cooler Combined.
The ice as it melts is filtered.
No other gravity filter does this.
The McConnell Filter Co.
POLAR ELECTRIC. **BUFFALO, N. Y.**

CHOLERA: EPIDEMIOLOGY OF.— By Dr. G. Archie Stockwell. An interesting and valuable paper on the dissemination of the Asiatic Cholera, showing what does and what does not spread the disease. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. **888.** Price 10 cents. To be had at this office and from all newsdealers.



COMPLETE ELECTRICAL EQUIPMENTS
—FOR—
ARC OR INCANDESCENT LIGHTING.
Arc Lamps. Incandescent Lamps. House Wiring Appliances.
MINIATURE ·:· LAMPS ·:· FOR ·:· DECORATIVE ·:· PURPOSES.
GENERAL ELECTRIC COMPANY,
DISTRICT OFFICES:

44 Broad Street.....New York.	620 Atlantic Avenue.....Boston, Mass.
173 and 175 Adams Street.....Chicago, Ill.	509 Arch Street.....Philadelphia, Pa.
Fifth and Race Streets.....Cincinnati, O.	401-407 Sibley Street.....St. Paul, Minn.
Equitable Building.....Atlanta, Ga.	1333 F Street, N. W.....Washington, D. C.
15 First Street.....San Francisco, Cal.	Masonic Temple.....Denver, Colo.

All business outside the U. S. transacted by Thomson-Houston International Electric Co. 44 Broad St. New York

ENGINES, BOILERS & MACHINE TOOLS. Complete outfits furnished. *Send for prices and 300 p. catalogue.* W. P. DAVIS, Rochester, N. Y.

The American Bell Telephone Company
125 MILK ST., BOSTON, MASS.

This Company owns the Letters Patent No. 186,787, granted to Alexander Graham Bell, January 30, 1877, the scope of which has been defined by the Supreme Court of the United States in the following terms:

"The patent itself is for the mechanical structure of an electric telephone to be used to produce the electrical action on which the first patent rests. The third claim is for the use in such instruments of a diaphragm, made of a plate of iron or steel, or other material capable of inductive action; the fifth, of a permanent magnet constructed as described, with a coil upon the end or ends nearest the plate; the sixth, of a sounding box as described; the seventh, of a speaking or hearing tube as described for conveying the sounds; and the eighth, of a permanent magnet and plate combined. The claim is not for these several things in and of themselves, but for an electric telephone in the construction of which these things or any of them are used."

This Company also owns Letters Patent No. 463,569, granted to Emile Berliner, November 17, 1891, for a Combined Telegraph and Telephone; and controls Letters Patent No. 474,231, granted to Thomas A. Edison, May 3, 1892, for a Speaking Telegraph, which cover fundamental inventions and embrace all forms of microphone transmitters and of carbon telephones.

THE SCIENTIFIC AMERICAN

☞ **ESTABLISHED 1845.**
The Most Popular Scientific Paper in the World
Only $3.00 a Year, Including Postage.
Weekly—52 Numbers a Year.

This widely circulated and splendidly illustrated paper is published weekly. Every number contains sixteen pages of useful information and a large number of original engravings of new inventions and discoveries, representing Engineering Works, Steam Machinery, New Inventions, Novelties in Mechanics, Manufactures, Chemistry, Electricity Telegraphy, Photography, Architecture, Agriculture, Horticulture, Natural History, etc. Complete list of patents each week.

Terms of Subscription.—One copy of the SCIENTIFIC AMERICAN will be sent for *one year*—52 numbers—postage prepaid, to any subscriber in the United States, Canada, or Mexico, on receipt of **three dollars** by the publishers; six months, $1.50; three months, $1.00.

Clubs.—Special rates for several names, and to Post Masters. Write for particulars.

The safest way to remit is by Postal Order, Draft, or Express Money Order. Money carefully placed inside of envelopes, securely sealed, and correctly addressed, seldom goes astray, but is at the sender's risk. Address all letters and make all orders, drafts, etc., payable to
MUNN & CO., 361 Broadway, New York.

THE Scientific American Supplement

This is a separate and distinct publication from THE SCIENTIFIC AMERICAN, but is uniform therewith in size, every number containing sixteen large pages full of engravings, many of which are taken from foreign papers and accompanied with translated descriptions. THE SCIENTIFIC AMERICAN SUPPLEMENT is published weekly, and includes a very wide range of contents. It presents the most recent papers by eminent writers in all the principal departments of Science and the Useful Arts, embracing Biology, Geology, Mineralogy, Natural History, Geography, Archæology, Astronomy Chemistry, Electricity, Light, Heat, Mechanical Engineering, Steam and Railway Engineering, Mining, Ship Building, Marine Engineering, Photography, Technology, Manufacturing Industries, Sanitary Engineering, Agriculture, Horticulture, Domestic Economy, Biography, Medicine, etc. A vast amount of fresh and valuable information obtainable in no other publication.

The most important Engineering Works, Mechanisms, and Manufactures at home and abroad are illustrated and described in the SUPPLEMENT.

Price for the SUPPLEMENT for the United States, Canada, and Mexico, $5.00 a year; or one copy of the SCIENTIFIC AMERICAN and one copy of the SUPPLEMENT, both mailed for one year to one address for $7.00. Single copies, 10 cents. Address and remit by postal order, express money order, or check,
MUNN & CO., 361 Broadway, New York.

Building Edition.

THE SCIENTIFIC AMERICAN ARCHITECTS' AND BUILDERS' EDITION is issued monthly. $2.50 a year. Single copies, 25 cents. Thirty-two large quarto pages, forming a large and splendid Magazine of Architecture, richly adorned with *elegant plates in colors*, and with other fine engravings; illustrating the most interesting examples of modern architectural construction and allied subjects.

A special feature is the presentation in each number of a variety of the latest and best plans for private residences, city and country including those of very moderate cost as well as the more expensive. Drawings in perspective and in color are given, together with Plans, Descriptions, Locations, Estimated Cost, etc.

The elegance and cheapness of this magnificent work have won for it the Largest Circulation of any Architectural publication in the world. Sold by all newsdealers. $2.50 a year. Remit to
MUNN & CO., Publishers,
361 Broadway, New York.

PRINTING INKS.

The SCIENTIFIC AMERICAN is printed with CHAS. ENEU JOHNSON & CO.'S INK, Tenth and Lombard Sts., Philadelphia, and 47 Rose St., opp. Duane, New York

© 1893 SCIENTIFIC AMERICAN, INC.